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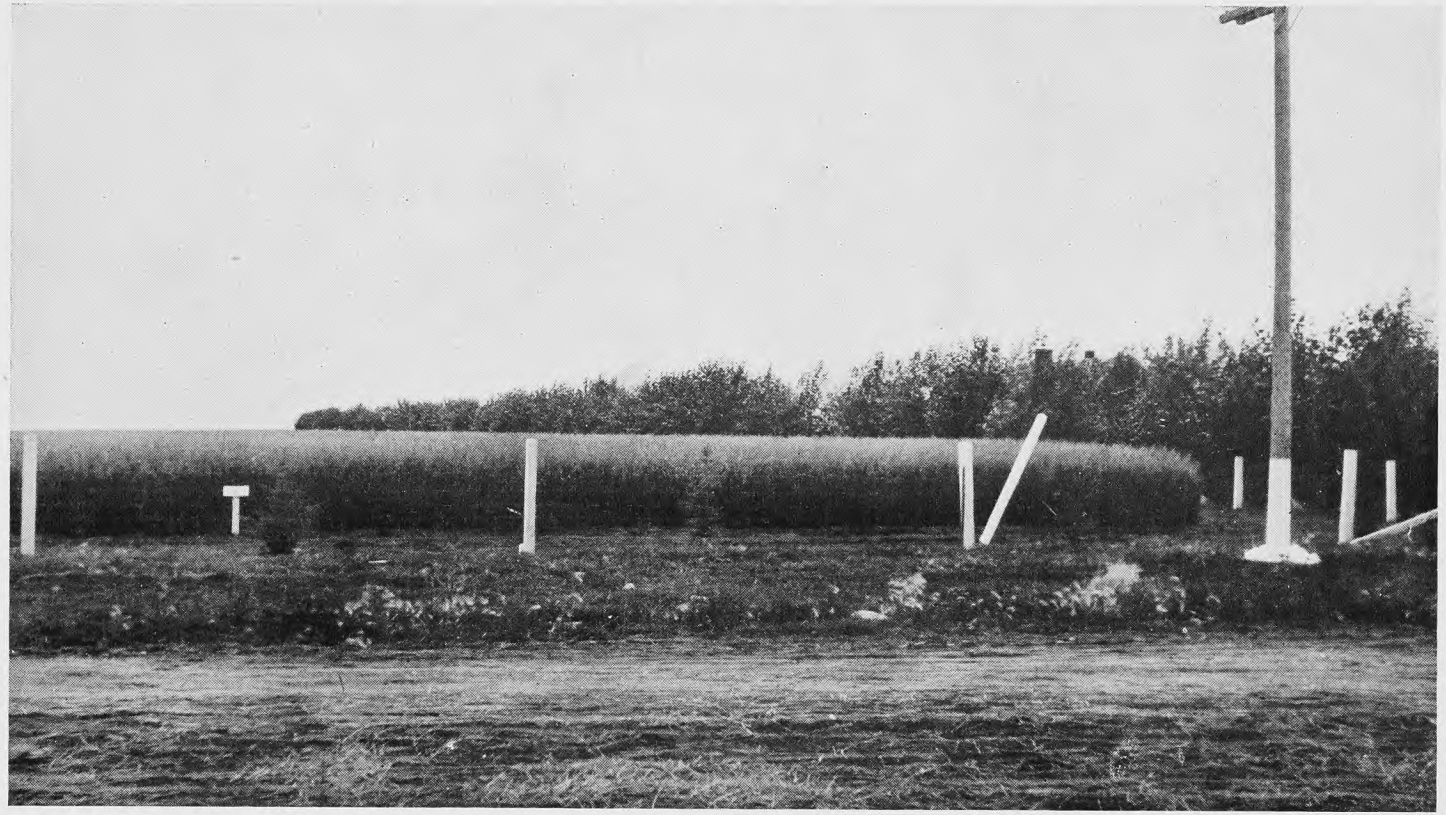
Hon. ARTHUR MEIGHEN, Minister; W. W. CORY, Deputy Minister

Reclamation Service—E. F. DRAKE, Director

REPORT ON IRRIGATION SURVEYS AND INSPECTIONS

1918-19

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY.
1920



Oats on Irrigated Alfalfa Sod.
Cut for ensilage in August 1917 and yielded at the rate of 11·06 tons of green oats per acre. Sown on June 4th.

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DIAGRAMS.

RECLAMATION.

REPORT OF THE DIRECTOR OF THE RECLAMATION SERVICE, E. F. DRAKE.

The branch of the departmental service formerly known as the "Irrigation Branch" was, by authority of an Order in Council dated December 31, 1918, superseded by "The Reclamation Service." The change became necessary because of the increasing importance of the administrative work relating to drainage by virtue of agreements between the Dominion Government and the Governments of the provinces of Alberta and Saskatchewan as confirmed by provincial legislation, viz.: "The Reclamation Act" of the province of Alberta, and "the Reclamation Act, 1917," of the province of Saskatchewan. In so far as the Dominion Government is concerned, the agreement previously referred to was confirmed by drainage regulations sanctioned by an Order in Council dated January 14, 1919, and by "The Reclamation Act," chapter 5 of the statutes of 1919.

This legislation marks the successful conclusion of negotiations carried on for several years between the Dominion Government and the Governments of the provinces of Alberta and Saskatchewan for the reclamation of submerged or swamp lands by drainage, and paves the way for a progressive policy whereby large areas of now worthless land in these provinces may be reclaimed and made productive. It is anticipated that the Manitoba Government, with whom similar negotiations were carried on, will before long enact legislation on somewhat similar lines.

The problem presented by drainage in these provinces was peculiar. The ownership and control of all sources of surface water supply, including lakes, marshes, etc., is vested in the Dominion Government, which also owns the unalienated public land, while control of the drainage of land is vested in the Provincial Governments. This divided jurisdiction had invited controversy and had seriously interfered with the reclamation of submerged or swamp land and with the construction of roads, and, generally, had exercised a retarding effect upon the settlement and development of the districts comprising any considerable areas of such land.

The present arrangement is in the nature of a compromise of the apparently conflicting interests. Where drainage districts are organized in accordance with provincial laws the Dominion Government will, under certain conditions, transfer to the province, at a nominal price, any vacant Dominion lands within such districts in order that such lands, when reclaimed, shall be assessable for their fair share of the cost of their reclamation, and be thereafter sold by the province at public auction subject to such conditions as may be agreed upon at the time of the transfer. On the other hand, the Provincial Governments will, when the Dominion Government desires to take the initiative in the construction of drainage works, place at the disposal of the Dominion all their legislative machinery, upon the condition that the lands when reclaimed shall be sold at public auction, and that the purchasers shall thereafter become responsible for the maintenance of the drains, in the same manner as if the works had been initiated by the settlers themselves under provincial laws.

Provision is made in the Dominion Reclamation Act that the Governor in Council may, upon the passing of the necessary legislation by the legislature of the province of Manitoba, make the said Act extend and apply to Dominion lands situated in that province.

CLIMATIC AND CROP CONDITIONS FOR 1918.

Reference was made in my report of last year to the high cost of labour and material, which had, to a very great extent, discouraged construction work. These conditions continued throughout 1918, and, as a result, very little actual construction work was undertaken. Climatic conditions during the past year, from the standpoint of the farmer in Western Canada, could not well have been worse. The season of 1917 had been exceedingly dry and this condition continued throughout the whole of the following year, with the result that the scanty supplies of moisture stored in the soil were gradually depleted and were not replenished by natural rainfall. The result was extreme drought throughout southern Alberta and southwestern Saskatchewan, and practical crop failure, except in particularly favoured localities or where the land had been carefully summer-fallowed.

In the central and northern portions of both provinces a very severe frost occurred on or about July 25—an almost unprecedently early date for killing-frost. The result was that the wheat crop for the province of Alberta averaged about 6 bushels per acre, and the oats crop 23 bushels per acre, while in the province of Saskatchewan the yields were 10 bushels for wheat and 21·5 bushels for oats.

In addition to the practical failure of the grain crops, the feed question became very acute. Pastures practically dried up; very little hay for winter feed could be harvested in the south, and the carrying of cattle through the winter became an exceedingly difficult problem. Fortunately, the winter of 1918-19 proved to be exceptionally mild and open, without severe storms. This, coupled with the assistance rendered by the Dominion and Provincial Governments and by the railway companies in transporting forage from the north or carrying cattle to the north, where they could be more cheaply fed, enabled the settlers to tide over the winter. More extended reference to the questions of forage and winter feeding of cattle will be found in the report of the Commissioner of Irrigation, which is submitted herewith.

Following the mild winter, the spring of 1919 opened very auspiciously—with an early break-up and fine mild weather. A very large acreage was sown unusually early and prospects were more than usually bright until in late spring and early summer hot, dry winds and scanty rainfall blasted the hopes of the settlers. The long continued drought, and prevalence of hot winds throughout a considerable portion of the season indicate, at the time this report is written, that in the southern portions of the provinces of Alberta and Saskatchewan there will be practically a complete crop failure, except, possibly, in a few specially favoured localities or where irrigation has been practised.

In the tabulated statement which follows, an attempt has been made to show the close relationship existing between rainfall and the yield of some typical field crops in Alberta and Saskatchewan.

It will be observed that the rainfall since 1915 has been scanty and slowly decreasing in depth, while for the same period the yield per acre has been decreasing on a more rapid scale. The conclusion to be drawn from this is, that the cumulative effect of a succession of dry years is a considerable depletion below normal of soil moisture and a consequent much greater proportional reduction of fertility.

In 1917, although the crop was below normal, enhanced prices made production about as profitable as in 1916 when the yield was above normal. The year 1918, however, did not bring a sufficiently substantial increase in prices to compensate for the decreased yield.

In Saskatchewan the area of each crop for 1918 was greatly in excess of the corresponding area in 1917 but the total yield was considerably less in each case. The same statement applies pretty closely to Alberta, except in the case of barley, where the area cropped was less than in 1917. But in this case, also, as might be supposed, the total yield was not proportionately as great as in 1917.

The causes for these conditions are to be found, primarily, in the drought of 1917 and 1918, but a great deal is also due to the severe frosts which occurred in the latter part of July, 1918, in Northern and Central Alberta and Saskatchewan.

The following tables are based upon the best obtainable information. The 'normal prices' are estimated, and are, possibly, rather high, but precise information of average prices for past years is not readily obtainable:—

TABLE showing Yields of Wheat, Oats and Barley in Alberta, for the years 1915, 1916, 1917 and 1918.

Crop and Year.	Yield per Acre.	Average Price per Bushel.	Average Price per Acre.		Yield per Acre.	Rainfall at Calgary, April to August.	
Wheat—	Bush.	$	$	%	%	Inches.	%
Normal	22·50[1]	1·00[2]	22·50	100	100	11·56[3]	100
1915	31·12	·88	27·39	122	138	12·27	106
1916	24·99	1·33	33·24	148	111	8·93	77
1917	18·25	1·74	31·76	141	81	6·63	57
1918	6·00	1·92	11·52	51	27[4]	5·78	50
Oats—							
Normal	42·00[1]	·34[2]	14·28	100	100		
1915	45·91	·31	14·23	100	109		
1916	48·11	·46	22·13	155	115		
1917	34·00	·63	21·42	150	81		
1918	22·75	·73	16·61	116	54		
Barley—							
Normal	28·25[1]	·50[2]	14·12	100	100		
1915	32·31	·44	14·22	101	114		
1916	29·04	·71	20·62	146	103		
1917	22·00	·98	21·56	153	78		
1918	16·50	·97	16·00	113	58		

[1] Average for 10 years, 1908–1917. [2] Estimated. [3] Average for 30 years 1885–1914. [4] Results affected by frost 25th July, 1918.

TABLE showing Yields of Wheat, Oats and Barley in Saskatchewan for the years 1915, 1916, 1917 and 1918.

Crop and Year.	Yield per Acre.	Average Price per Bushel.	Average Price per Acre.		Yield per Acre.	Rainfall at Swift Current from April to August.	
Wheat—	Bush.	$	$	%	%	Inches.	%
Normal	18·50[1]	1·00[2]	18·50	100	100	10·00[3]	100
1915	25·12	·91	22·86	124	136	10·14	101
1916	16·34	1·28	20·92	113	88[4]	14·09	141
1917	14·25	1·95	27·79	150	77	5·12	51
1918	10·00	1·99	20·00	108	54[5]	5·62	56
Oats—							
Normal	38·25[1]	·34[2]	13·00	100	100		
1915	43·48	·32	13·91	107	114		
1916	43·06	·46	19·81	152	113		
1917	27·25	·62	16·90	130	71		
1918	21·50	·70	15·05	116	56		
Barley—							
Normal	26·75[1]	·50[2]	13·38	100	100		
1915	31·74	·46	14·06	109	119		
1916	27·00	·77	20·08	155	101		
1917	21·00	1·00	21·00	157	79		
1918	17·00	·88	14·96	112	67		

[1] Average for 10 years, 1908–1917. [2] Estimated. [3] Average for 30 years, 1885–1914. [4] Results affected by rust. [5] Results affected by frost 25th July, 1918.

AWAKENED INTEREST IN IRRIGATION.

As the result of successive dry seasons and partial or complete crop failure there has been a sudden and widespread awakening to the value of irrigation either as a form of crop insurance, or as a necessity to successful farming in the semi-arid regions of Southern Alberta and Saskatchewan. In his report which is submitted herewith the Commissioner of Irrigation has discussed this in such detail that little further comment is required. I desire, however, to draw attention to a few phases of the problem to which the Commissioner has not referred.

In the early days of irrigation development the then Commissioner, Mr. J. S. Dennis, roughly defined the so-called semi-arid district as a tract of some 50,000,000 acres, bounded roughly as follows: From the international boundary northward along the lower slopes of the foot-hills of the Rocky mountains in Alberta to the north line of township 28: thence easterly along the township line to about range 10, west of the 4th meridian, thence north-easterly across the Alberta-Saskatchewan boundary to a point some 30 miles south of Battleford, thence south-easterly to the "elbow" of the South Saskatchewan river, and, following approximately the line of the Moosejaw-Portal branch of the Canadian Pacific railway, to the international boundary.

The cycle of wet years from about 1896 to 1909 caused many to assert either that it had been a mistake even to characterize this region as semi-arid, or that the climate has materially changed as the result of settlement and cultivation of the soil—and for the time these people seemingly had the better of the argument. But the recurrance of dry years, the serious crop failures resulting from drought in 1910, 1914, 1917 and 1918, with the present prospect of a more serious failure in 1919, amply justify Mr. Dennis' early summary of the case.

Assuming that there are some 50,000,000 acres of land requiring irrigation, or that would be benefited by irrigation, it has never been asserted that all of this land could, or should be irrigated. Much of it is too high, or too rough to be irrigated from any available source of water supply, and other portions are unsuitable for irrigated farming for other reasons. There has been a considerable development of irrigated farming within this district as shown, approximately, in the following schedule:—

Constructed.

	Acres.	Acres.
Canadian Pacific Railway Projects—		
Western Section	223,000	
Eastern Section	400,000	
Lethbridge Section	130,000	
		753,000
Canada Land and Irrigation Company		202,000
Private (small) Projects		150,000
		1,105,000

Projected.

Lethbridge Southeastern (estimated area)	350,000
United Irrigation District (estimated area)	30,000
Lethbridge Northern (estimated area)	150,000
North Saskatchewan (estimated area)	1,000,000
	1,530,000

If all the irrigable lands within the projects now constructed are actually irrigated (which is by no means true), and if works were built to serve the lands in all the projects so far suggested for construction, the total irrigated area would be 2,635,000 acres, or about five per cent of the semi-arid district. It has been said that the available water supply in Western America, referring particularly to the Western United States,

is sufficient for the irrigation of about ten per cent of the total area of land requiring irrigation. The statement is probably true in a general sense and it may safely be assumed that even with the most careful system of conservation and use the water supply in Southern Alberta and Saskatchewan cannot be made to irrigate more than 5,000,000 acres, or ten per cent of the land that requires, or would be benefited by irrigation.

The principal streams traversing the region referred to are the North and South Saskatchewan, Bow, Red Deer, Waterton, Belly, St. Mary, Milk, and Oldman rivers.

Bow river supplies the Canadian Pacific Railway Company's several projects and that of the Canada Land and Irrigation Company. It may be found possible to so conserve its flow as to serve some additional land, but no considerable area.

St. Mary and Milk rivers are international streams, and part—approximately one-half—of their combined flow has been assigned by treaty to the United States; the remainder is already fully appropriated in Canada. The total flow of these streams, plus the Belly and the Waterton rivers, will barely suffice for, if indeed it does not fall short of, the requirements of the development already in contemplation, viz: The Lethbridge section of the Canadian Pacific Railway, the United Irrigation District, and the Lethbridge Southeastern project.

Oldman river will furnish about enough water for the proposed Lethbridge Northern project with its possible extensions.

Red Deer river flows in a deep and narrow valley from which it would be difficult and expensive, if not impossible, to divert it to adjacent lands.

Most of the smaller streams are already fully appropriated by settlers living along or near them, and little further development of this kind is possible except by the construction of reservoirs for the control of water that now runs to waste in periods of flood.

There remain the North and the South Saskatchewan rivers. The latter, formed by the Bow and Oldman, flows in a very deep, and generally quite narrow valley. It is believed to be impracticable, within reasonable cost limits, to divert water from it either by gravity or by pumping for the irrigation of the adjacent bench lands, although some development of the valley lands by pumping is quite feasible.

Investigations are now being made to determine the feasibility of diverting water from the headwaters of the North Saskatchewan near Rocky Mountain House, and carrying it eastward for the irrigation of a considerable, but as yet undefined area of land in Central Alberta and West Central Saskatchewan. It is probable that this may be found practicable from an engineering viewpoint, but surveys are not yet sufficiently advanced to warrant any conjecture as to the cost of the undertaking or its commercial feasibility. It may also be found possible to divert water from this stream at some other point for use in the same district, but no surveys of any description have yet been made to test this.

It is thus apparent that further irrigation development is only possible within somewhat narrowly circumscribed limits, and many of those who are now agitating for the extension of existing irrigation systems, and for the development of new ones, are doomed to disappointment.

Irrigation should be developed as fully and as rapidly as possible, but the available water supply will not suffice, and cannot be made to suffice, for the irrigation of more than a small fraction of the area for which water is required. And this is true even though stream flow be controlled and waste prevented by means of storage and regulating reservoirs.

The most disappointing feature of present-day irrigation development in Western Canada is the undisputed fact that in spite of successive dry years, and repeated crop failures, many of those who have water available have failed to use it when use would have saved their crops. Works built at considerable expense have been permitted to decay and have not been repaired because, in some years, the rainfall was sufficient

for crop production and it was believed, or rather hoped, that each succeeding year would be a "wet" one. Thus when the drought came the restoration of the works was deferred from day to day in the hope that rain would make their restoration unnecessary, and when finally water was required immediately to save the crop, the repairs could not be made in time, and the crop was lost.

REPORT ON IRRIGATION AND CANADIAN IRRIGATION SURVEYS.

By F. H. PETERS, *Commissioner of Irrigation and Chief Engineer.*

In submitting this annual report attention is directed to the change in the form of submission that has been made. In an endeavour to condense the report as much as possible and submit only such matter as is necessary for record, all the subject-matter has been dealt with in one summary report. No original reports are submitted, but as a matter of record the names of all engineers in charge of any important part of the work have been mentioned. All efforts to prepare the report in an attractive manner have been sacrificed to the direct scheduling of the more important features of the work in brief form.

All original reports are filed at Calgary and Ottawa and in so far as possible the complete information will be made available to persons who are particularly interested in any special feature of the work.

ORGANIZATION OF STAFF.

The organization of the staff was similar to that of last year with the proposed change carried into effect of combining the irrigation and hydrometric work in certain districts. All field survey development work having been discontinued, the staff, mainly in the field, but also in the office, has been correspondingly decreased in comparison with the years prior to 1917. A number of men on the permanent staff left our employ during the year, being drawn away by the considerably higher remuneration offered by private corporations. This had the effect of disorganizing the staff, and particularly in the hydrometric division the office was undermanned during the whole of the year. Exclusive of summer assistants and other temporary employees, the number of persons employed on the staff was forty-three; twenty-nine being employed in the office and fourteen in the field.

STREAM ADMINISTRATION.

The very important work of transferring our records to the new system which has been developed was carried on actively throughout the year. Mr. C. M. Arnold, acting as water administration engineer devoted all of his time to this work and a great deal of progress was made during the year in getting all the various details finally worked out. The difficulty was again experienced with many knotty points that had to be dealt with, but it now appears that most of these have been straightened out and the largest part of the work remaining will be the final typing and checking of all the records.

HYDROMETRIC SURVEYS.

The following extracts from a report submitted by Mr. P. M. Sauder cover, in a brief and general way, the work carried on by the hydrometric surveys division during the year:—

> "In order to economize as much as possible, only the most important work was undertaken. A number of the less important gauging stations were discontinued and the regular field staff was reduced to nine district engineers during

the open-water period. Five of these did hydrometric work only, but the remaining four did irrigation inspections also, and therefore only spent part of their time on hydrometric work. The engineer in charge of the Calgary district also looked after the current-meter rating station. During the winter period there were seven field engineers who spent all of their time on hydrometric work.

"During the open-water period records were taken at 138 regular gauging stations on streams in Alberta and Saskatchewan, at about 110 gauging stations on irrigation ditches and canals and at 19 stations on lakes. Winter records were taken at ninety stations on streams during the past winter.

"During the year forty-four current-meters were rated. Fourteen belonged to the British Columbia Hydrometric Survey, three to the Manitoba Hydrometric Survey, one to the Ontario Hydro-Electric Power Commission, two to the Canadian Pacific Railway Company, and the balance, twenty-four, belong to this office.

"The staff was increased at the beginning of the year for the purpose of bringing the office work up-to-date, and it was planned to have the daily discharges computed regularly as the records came in, instead of leaving most of this work until the winter months. We were unable, however, to maintain the necessary staff, and the office work is still behind. During 1918, there was a scarcity of engineers, and many openings became available for members of our staff. In the nine months from April to December, fifty per cent of the staff of engineers on hydrometric work resigned. As a consequence many of the best qualified and most experienced engineers left and had to be replaced by engineers with no previous experience in hydrometric work. This seriously affected the efficiency of the staff, as it takes considerable time to gain the information and experience necessary to do good work. The field work was kept up but the office work fell behind.

"The records for the past year are of considerable value as 1918 was an exceptionally 'dry' summer. The spring break-up was quite normal in the mountain streams, but on the prairie it came very suddenly, and as the ground was frozen a large portion of the melted snow rushed into the streams and many of the small prairie streams were abnormally high. Only a small portion of water went into the ground and, followed by a summer of low precipitation, the prairie and foot-hill streams soon fell below normal and remained so for the remainder of the year. The high temperatures, however, kept the mountain streams nearly up to normal during the summer. When the temperature in the fall became too low to melt snow the mountain streams also fell, and the flow for most streams during the winter of 1918 was exceptionally low.

"The results of the special investigations of Sturgeon-weir and Churchill rivers, near the Manitoba-Saskatchewan boundary, started in the fall of 1917, proved to be of considerable value and were, therefore, resumed last fall. These streams have good winter flows, and favourable sites for water-power development exist. They will, therefore, probably assist in the early development of rich mineral deposits in that locality. Now that the war has terminated, the development of the resources in the north country will probably be resumed, and we should, therefore, plan to extend our investigations of the winter flow of the larger streams in Northern Alberta and Saskatchewan.

"During the year the investigations of lake levels were increased, and during the past few months a number of stations were installed on lakes and marshes and lake outlets for the purpose of gaining records for the study of drainage schemes."

FIELD WORK.

Reference was made in last year's report to the very difficult condition concerning water supply for domestic, municipal, and industrial purposes over a considerable

area of the drier parts of Alberta and Saskatchewan and to the efforts that were being made to collect data for use in bettering of these conditions. This work has been actively followed up during the past year by our inspecting engineers, who have submitted reports concerning all domestic water supplies and wells that came to their notice throughout the country. We have also been able to catalogue considerable data of this kind which have been submitted by other persons and organizations interested in the development of this area.

In this connection the summary report of the Geological Survey for 1915 contained a report and map by Dr. D. B. Dowling, which outlined the probable artesian well area in that very dry region east of Lethbridge. It is interesting to note, as the result of the Dominion Government's activity in this matter, that up to 1918 the drilling of thirty successful wells had been reported in this area. The drilling of these wells proves the general correctness of the artesian area as defined by Dr. Dowling, except along the extreme eastern edge, where up to date no drilling has been reported.

A commencement was made last year to reinspect all stock-watering reserves. No special staff has been available for this work and it has been necessary to make the best progress possible by fitting it in with the other duties of our inspecting engineers. During 1917, fifty-nine reserves were inspected, and during 1918, fifty.

As indicated under that heading, the field work on the hydrometric surveys was carried on during both the summer and winter seasons in such a manner as to ensure the continuity of our stream flow records. Otherwise, as a general rule, only such field work as was necessary for administration was carried on. The small amount of special field work which was done is referred to briefly below.

A short field reconnaissance was made on the Lethbridge Northern project and will be referred to further under that heading.

Mr. J. S. Tempest carried out the construction of a small earth dam at the outlet of Elkwater lake. This lake lies in the Cypress Hills Forest Reserve about thirty miles southeast of Medicine Hat and is frequented as a summer resort by a number of people. The dam was built with a view to maintaining the water level at a certain elevation, in order to improve the lake as a summer resort. The lots laid out around the lake are owned by the Dominion Government.

In the late fall Mr. Tempest also spent several weeks making a preliminary survey to gain some additional information regarding the feasibility of draining Waterhen lake and marsh which lie about thirty-five miles southeast of Prince Albert.

During the fall of 1917 some river improvement work was undertaken on the Highwood river a few miles above the town of High River. The works, consisting of pile deflecting groins and an earth levee, were built to stop the Highwood from changing its whole course and running down the Little Bow river. Observations of the high water level in the Highwood river during the spring freshets of 1918 showed that the lower part of the earth levee was not high enough to be safe during a really big flood. In the fall of 1918 a camp was erected and by utilizing our own horses, the levee was raised to what is considered to be a safe elevation.

The same plan as last year was followed in combining the irrigation and hydrometric work in the Cypress Hills country. Instead of requiring four inspecting engineers, however, as had previously been the case when using horse transport, the work was handled by two, each provided with one assistant and a Ford motor car.

Cypress Hills District Northwest.—This district was handled by Mr. J. S. Tempest, who took the field on April 23 and continued work until October 18, when he was transferred to other work. The seasons work comprised 198 actual working days. Ninety-seven inspections and seven surveys were made. Eighty-six stream gaugings were made and data gathered concerning thirty-seven wells. The number of miles travelled by train was 1,648 and by motor car 7,286. Some of the most interesting parts of Mr. Tempest's report are quoted in the following paragraphs:—

"The 1918 season was one of the leanest that has visited the Cypress Hills district for many years. Even the careful methods of those who practise dry farming generally proved abortive or yielded such a meagre increase as to be practically a failure.

"There was little moisture in the soil at the beginning of the season and the precipitation during the summer was too insignificant to do any good. The whole country presented a stretch of brown, arid plains with narrow strips of green in the few favoured valleys and flats that had been naturally flooded or artificially watered by some irrigation scheme during the early spring run-off. Many of the creeks ran dry quite early in the season and the general aspect in some places approached very nearly to one of desolation. The shacks of the recent settlers, the farm houses of the older residents and even many of the old-time ranch-houses were often deserted, especially in localities situated at a considerable distance from the Cypress hills. Some of the men had gone to war, some, especially those with domestic responsibilities, had moved to towns and other places where work could be obtained. Some ranchers, recognizing the inevitable dearth of feed that would follow such a season of drought, either sold out their stock, greatly reduced their herds or moved to better pastures in other parts of the country. This widespread exodus was attributable almost entirely to the two years of drought.

"Of those who remained in the country many were only able to do so through the advantages offered by neighbouring sloughs and lands that had been either naturally or artificially flooded. Some again were able by reducing their stock and paying a high price for hay to tide over the bad times.

"With few exceptions the only people in the district that worked their farms at a profit were those who owned irrigated lands. Some of these, owing largely to the high price of hay and beef cattle, as well as other produce, found it a year of exceptional profit.

"Generally speaking irrigation was not satisfactorily carried out in the district. Approximately only fifteen per cent of the owners of schemes made full use of the water available; forty-nine per cent made only a partial use of the water available, many of these being content with natural flooding, while thirty-six per cent of the total number of schemes were not used at all.

"The great advantages of irrigation in this semi-arid district are so manifest, it seems strange how many farmers have allowed their works to fall into bad repair and year after year procrastinate in putting in the necessary improvements. Certainly labour has been difficult to get during the past four years, but in many instances this difficulty was by no means insurmountable, and no doubt many use scarcity of labour as a stock excuse where indifference would be nearer the mark. Quite a number have more extensive schemes than they can handle efficiently without the outlay of considerable capital in labour and maintenance, and there are so few shining examples of successful up-to-date irrigation projects to show them the way, they prefer to allow things to slide, quite content as long as they can make a fair living.

"As suggested in my 1917 report, a lack of even the most elementary knowledge of the methods of manipulating an irrigation project to advantage is very widespread and there are very few practical irrigators in the district to serve as examples to those desirous to learn. One good irrigation project worked on practical lines and showing successful results, would do infinitely more good in promoting knowledge of the best irrigation practice than any amount of precept gained from pamphlets and lectures."

Cypress Hills District Southeast.—This district was handled by Mr. M. H. French who took the field on March 21 and completed his field work on November 11. The season's work comprised one hundred and ninety-six actual working days. One hun-

dred and forty-five inspections and seven surveys were made. Three hundred and fifty-six stream gaugings were made and two new gauging stations were established. Data were gathered concerning seventy-seven wells and four domestic water supplies. The number of miles travelled by train was 2,471, by hired livery 947, and by motor car 7,299. These figures include the work done on the special measurement of early spring run-off.

Mr. French's report does not contain any item of special interest except that, like Mr. Tempest, he makes a strong statement concerning the scarcity of irrigation demonstration work in this district. The department's attention has been repeatedly called to the urgent necessity for this work, but so far it has not been possible to do anything that has been effective. Now that the after-war conditions make the necessity for production so urgent it would appear, if the means cannot be made available to carry on some demonstration work in addition to the work of stream measurements and general administration work, that the advisability should be considered of dropping or greatly curtailing this work, and devoting whatever moneys may be available to practical demonstration work. At the present time this industry is not productive and it would seem that the first practical necessity should be to make the industry productive. One or two irrigation demonstration stations in this district would have the potentiality of producing practical irrigation on sixty thousand acres of land within comparatively few years.

Macleod District.—This district was handled by Mr. F. S. Drummond, who took the field on July 8, and finished the season's field work on December 31. The season's work comprised one hundred and forty-six actual working days. Fifty-seven inspections and two surveys were made. Two hundred and thirty-five stream gaugings were made and data were gathered concerning sixty-one wells. The number of miles travelled by train was 830, and by motor car 5,461. The irrigation and hydrometric work in the district were combined and the engineer was provided with a Ford motor car for transportation and with an assistant.

The Macleod district includes all the famous foot-hills country from Calgary south to Macleod. This district is pre-eminently a stock country and probably runs more stock than any other equal area in Western Canada. There are about twenty-one thousand acres that can be irrigated by the small private schemes and this area is all capable of raising abundant forage crops. At the present time, with a few notable exceptions, the irrigation schemes are not being operated. The past season was a very dry one in this district and there was very little hay cut. Most of the ranchers went into the winter without a sufficient quantity of hay and faced a catastrophe in the event of a hard winter. Fortunately Providence provided an exceptionally mild winter and so the stock was saved. If the irrigation schemes were operated, enough hay could be produced in the very driest years to carry through one-third of the total number of stock in the district, no matter how severe the winter. During any period of years the irrigated lands sown to forage crops will produce far more than dry lands. The actual development of these irrigable lands is very slow, but gradually the more progressive stock-men are getting their schemes in shape and preparing to cultivate the land and grow fodder crops.

Special Inspections—Domestic, Municipal, Irrigation and Industrial.—This work was carried on under the immediate supervision of the office engineer. Mr. W. E. G. Hall acted as office engineer during the earlier part of the year and on his resigning from the service, his position was filled by Mr. E. L. Miles. The office engineer supervises the work of all inspecting engineers and particularly that of the two special inspectors, and sees that for each trip the inspections are properly grouped, as regards economy of time, travel, expense and the urgency of an early report. The office engineer examined and checked three hundred and forty-eight plans of all descriptions including forty-six descriptions for right of way.

The total number of inspections made in Saskatchewan by Mr. Miles was seventy-five, including eleven surveys of all descriptions involving 8,671 miles of travel by train and 1,640 miles by motor car or other means.

Mr. Miles' report refers in an interesting manner to the many unlicensed domestic water supply schemes which exist in the southern and western portions of Saskatchewan, and which have never been reported. He suggests that the difficulty lies in the fact that there is a general ignorance among the farmers and municipal organizations regarding the ownership of surface water in the province, and that this difficulty should be overcome by advertising the requirements of the Irrigation Act. Many similar unlicensed schemes exist in the southern portions of Alberta.

It has been the policy, particularly during the past two years, to require every inspecting engineer to report every unlicensed water supply scheme which may come to his notice. As to advertising the requirements of the law, the department will shortly issue a bulletin dealing with* "Farm Water Supply" which will display the following statements prominently: "All surface water in the provinces of Alberta and Saskatchewan belongs to the Crown. Every person who has a stream or lake within or bordering his land, is entitled to use so much of the water as is required for domestic purposes, which includes household use, watering of stock, and the working of agricultural machinery. It is necessary under the law to obtain authorization and license for the construction of works, such as dams and ditches, for storing or diverting any surface water. Small farmers' dams have been built without authorization or license and are still in existence. If dams or any other works are authorized and licensed under the Irrigation Act, their legal status is assured, and the farmer's water right is fully protected. If dams or other works are not authorized and licensed, they have no legal status and the water right is not protected. Any person wishing to make application for the construction of any works and a licensed water right, should apply to the Commissioner of Irrigation, Department of the Interior, Calgary."

Mr. Chambers acted as special inspector in Alberta, making a total of seventy-two inspections and ten surveys of all descriptions. He travelled 5,918 miles by train and 1,914 miles by motor car or other means.

MUNICIPAL WATER CONSUMPTION DATA.

The collection and compilation of municipal water consumption data was inaugurated towards the end of the year 1914, and in the year 1915 we received information complete for the year from fifteen cities and towns in Alberta and Saskatchewan. In the following year we received records for the whole year from the same cities and towns. During the year 1916 an endeavour was made to obtain this data from a greater number of places, with the result that for the year 1917 we received complete records from twenty-one cities and towns in Alberta and Saskatchewan. During 1918 records were received from eighteen cities and towns. These records have been compiled in a manner similar to former years and are submitted hereunder:—

* Bulletin No. 5 now ready for distribution.

Cities and Towns in the Province of Alberta.—Daily Record of Water Consumption in Imperial Gallons, for the Year 1918.

1918. — Month.	Edmonton. Population 54,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Lethbridge. Population 10,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	4,662,129	53·7	26·0	6·6	86·3	.....	1,443,194	97·0	47·3	.....	144·3	.....
February	5,388,000	61·8	27·6	10·4	99·8	.....	1,480,500	95·6	52·4	.....	148·0	.....
March	5,213,548	60·8	27·2	8·5	96·5	.....	1,432,774	94·9	48·4	.....	143·3	.....
April	4,935,400	59·0	24·8	7·6	91·4	.....	1,521,067	102·2	49·9	.....	152·1	.....
May	4,894,129	57·3	24·6	8·7	90·6	.....	1,680,097	115·5	47·6	4·9	168·0	.....
June	5,028,767	57·5	25·3	10·3	93·1	.....	1,884,467	121·6	56·2	10·6	188·4	.....
July	5,346,645	59·0	26·9	13·1	99·0	.....	1,968,000	127·1	54·4	15·3	196·8	.....
August	5,212,677	57·6	26·9	12·0	96·5	.....	1,561,064	108·0	42·5	5·6	156·1	.....
September	5,207,267	58·2	26·5	11·7	96·4	.....	1,278,233	93·2	34·6	.....	127·8	.....
October	5,272,903	57·0	26·6	14·0	97·6	.....	1,240,903	85·9	38·2	.....	124·1	.....
November	4,962,900	55·5	26·5	9·9	91·9	.....	1,252,833	95·6	29·7	.....	125·3	.....
December	5,053,903	59·2	26·0	8·4	93·6	.....	1,249,419	90·1	34·8	.....	124·9	.....
Ave. for Yr.	5,098,189	58·0	26·2	10·1	94·3	.....	1,499,379	102·2	44·7	3·0	149·9	.....

1918. — Month.	Medicine Hat. Population 9,300. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Redcliff. Population 2,183. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	2,362,903	.....	.....	.....	254	.....	158,661	43·9	28·2	.....	72·1	.....
February	2,215,000	.....	.....	.....	238	.....	163,286	50·8	23·4	.....	74·2	.....
March	2,087,742	.....	.....	.....	224	.....	153,000	50·0	22·9	.....	72·9	.....
April	2,251,000	.....	.....	.....	242	.....	152,592	57·2	15·4	.....	72·6	.....
May	2,553,871	.....	.....	.....	274	.....	173,395	62·9	19·7	.....	82·6	.....
June	2,968,333	.....	.....	.....	319	.....	190,833	72·1	18·8	.....	90·9	.....
July	3,261,612	.....	.....	.....	351	.....	244,403	83·8	32·6	.....	116·4	.....
August	2,590,967	.....	.....	.....	278	.....	230,056	88·4	16·1	.....	104·5	.....
September	2,358,000	.....	.....	.....	253	.....	217,517	70·7	28·2	.....	98·9	.....
October	2,326,129	.....	.....	.....	250	.....	223,814	80·9	20·9	.....	101·8	.....
November	2,113,000	.....	.....	.....	227	.....	221,100	67·1	21·3	.....	88·4	.....
December	2,407,097	.....	.....	.....	258	.....	199,419	68·7	21·9	.....	90·6	.....
Ave. for Yr.	2,457,971	.....	.....	.....	264	.....	194,006	66·4	22·4	.....	88·8	.....

1918. — Month.	Stettler. Population 1,200. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Claresholm. Population 1,092. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	11,622	9·7	.....	.....	9·7	.....	81,097	78·5	2·3	0·3	81·1	.....
February	7,925	6·6	.....	.....	6·6	.....	81,000	78·1	2·7	0·2	81·0	.....
March	11,014	9·2	.....	.....	9·2	.....	70,064	67·7	2·3	.....	70·0	.....
April	11,623	9·7	.....	.....	9·7	.....	71,200	68·9	2·0	0·3	71·2	.....
May	14,861	12·4	.....	.....	12·4	.....	91,906	71·0	4·1	8·5	83·6	.....
June	17,253	14·4	.....	.....	14·4	.....	130,100	99·5	7·3	11·5	118·3	.....
July	14,124	11·7	.....	.....	11·7	.....	122,581	105·6	2·6	3·2	111·4	.....
August	14,034	11·7	.....	.....	11·7	.....	109,774	77·7	10·3	9·1	97·1	.....
September	12,707	10·6	.....	.....	10·6	.....	113,059	70·8	10·9	18·3	100·0	.....
October	13,606	11·3	.....	.....	11·3	.....	112,581	44·0	43·8	10·1	97·9	.....
November	12,721	10·6	.....	.....	10·6	.....	107,333	78·0	12·1	3·2	93·3	.....
December	12,810	10·7	.....	.....	10·7	.....	45,806	31·9	3·7	1·0	36·6	.....
Ave. for Yr.	12,861	10·7	.....	.....	10·7	.....	94,708	72·6	8·7	5·5	86·8	.....

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Cities and Towns in the Province of Alberta.—Daily Record of Water Consumption in Imperial Gallons.—Continued.

1918. — Month.	Bassano. Population 650. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Athabaska. Population 500. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	140,967	.....	The average consumption per day is estimated at 100,000 gallons, or 154 gallons per head.	.....	217	.....	10,887	21·8	.....	.....	21·8	.....
February	138,214	.....		.....	212	.....	12,054	24·1	.....	.....	24·1	.....
March	142,322	.....		.....	219	.....	15,726	31·4	.....	.....	31·4	.....
April	161,000	.....		.....	248	.....	15,000	30·0	.....	.....	30·0	.....
May	170,484	.....		.....	262	.....	14,516	29·0	.....	.....	29·0	.....
June	175,667	.....		.....	270	.....	16,662	33·3	.....	.....	33·3	.....
July	141,774	.....		.....	218	.....	14,516	29·0	.....	.....	29·0	.....
August	110,645	.....		.....	170	.....	18,145	36·3	.....	.....	36·3	.....
September	108,166	.....		.....	167	.....	13,750	27·5	.....	.....	27·5	.....
October	119,519	.....		.....	184	.....	12,097	24·2	.....	.....	24·2	.....
November	120,333	.....		.....	185	.....	11,250	22·5	.....	.....	22·5	.....
December	117,000	.....		.....	180	.....	10,887	21·8	.....	.....	21·8	.....
Ave. for Yr.	137,174	.....	.....	.....	211	.....	13,791	27·6	.....	.....	27·6	.....

1918. — Month.	Carmangay. Population 400. Daily Average for the Month.	Per Head for domestic purposes.	Per Head for industrial purposes.	Per Head for other purposes.	Per Head for all purposes.	Unaccounted for.
January	12,000	28·1	.....	1·9	30·0	.....
February	12,000	28·9	.....	1·1	30·0	.....
March	11,226	28·0	.....	.....	28·0	.....
April	12,800	32·0	.....	.....	32·0	.....
May	12,000	30·0	.....	.....	30·0	.....
June	14,000	35·0	.....	.....	35·0	.....
July	12,774	30·0	.....	1·9	31·9	.....
August	13,161	31·0	.....	1·9	32·9	.....
September	12,800	32·0	.....	.....	32·0	.....
October	10,839	27·1	.....	.....	27·1	.....
November	12,000	30·0	.....	.....	30·0	.....
December	12,387	25·2	.....	5·8	31·0	.....
Average for the Year	12,332	29·8	.....	1·0	30·8	.....

Cities and Towns in the Province of Saskatchewan.—Daily Record of Water Consumption in Imperial Gallons, for the Year 1918.

1918. — Month.	Regina. Population 35,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Saskatoon. Population 25,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	2,440,446	59·3	10·4	.....	69·7	.....	1,632,774	25·2	18·9	2·7	65·3	18·5
February	2,476,866	59·5	11·2	.....	70·7	.....	1,735,928	26·6	19·9	2·9	69·4	20·0
March	2,359,089	56·1	11·3	.....	67·4	.....	1,821,903	28·3	21·2	3·1	72·8	20·2
April	2,500,142	60·6	10·3	0·5	71·4	.....	1,577,667	26·8	16·8	3·1	63·1	16·4
May	2,371,234	60·3	7·2	0·2	67·7	.....	1,476,484	25·6	15·5	2·9	59·0	15·0
June	2,529,408	65·6	6·4	0·2	72·2	.....	1,614,767	26·9	17·2	3·3	64·6	17·2
July	2,672,104	62·6	13·5	0·2	76·3	.....	1,605,870	30·2	16·3	2·4	64·2	15·3
August	2,453,590	55·2	14·6	0·3	70·1	.....	1,590,032	29·6	16·3	2·4	63·6	15·3
September	2,304,110	52·7	13·1	.....	65·8	.....	1,491,400	28·1	15·1	2·2	59·6	14·2
October	2,273,019	53·2	11·7	.....	64·9	.....	1,511,549	27·1	17·2	1·3	60·4	14·8
November	2,265,607	51·0	13·7	.....	64·7	.....	1,448,433	25·5	16·3	1·3	57·9	14·8
December	1,986,943	46·5	10·2	.....	56·7	.....	1,452,000	25·5	16·2	1·2	58·0	15·1
Ave. for Yr.	2,386,046	56·9	11·1	0·1	68·1	.....	1,579,900	27·1	17·2	2·4	63·1	16·4

Cities and Towns in the Province of Saskatchewan.—Daily Record of Water Consumption in Imperial Gallons.—Continued.

1918. — Month.	Moosejaw. Population 20,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	North Battleford. Population 4,000. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	885,613	36·2	10·4	.....	46·6	.....	154,423	11·2	16·2	2·3	38·6	8·9
February	921,429	36·8	8·1	.....	44·9	.....	155,544	10·6	19·8	.....	38·9	8·5
March	933,935	30·1	15·4	.....	45·5	.....	129,515	8·3	12·2	1·5	32·4	10·4
April	812,670	22·6	17·0	.....	39·6	.....	81,580	9·6	3·0	2·4	20·4	5·4
May	698,645	21·8	12·3	.....	34·1	.....	68,469	9·2	0·2	3·4	17·1	4·3
June	857,600	25·1	16·7	.....	41·8	.....	86,881	10·9	0·2	5·2	21·7	5·4
July	973,871	24·8	23·9	.....	48·7	.....	95,065	8·8	0·5	6·2	23·8	8·3
August	987,419	33·8	15·5	.....	49·3	.....	96,535	11·9	1·5	2·4	24·1	8·3
September	1,056,567	29·0	23·8	.....	52·8	.....	99,033	9·9	1·3	3·4	24·7	10·1
October	1,016,871	39·5	11·3	.....	50·8	.....	101,874	9·7	1·2	3·9	25·4	10·6
November	1,125,433	41·5	14·7	.....	56·2	.....	95,206	9·4	0·9	2·7	23·8	10·8
December	1,084,935	37·9	16·3	.....	54·2	.....	101,635	11·0	0·9	2·7	25·4	10·8
Ave. for Yr.	946,249	31·6	15·4	.....	47·0	.....	105,480	10·0	4·8	3·0	26·3	8·5

1918. — Month.	Weyburn. Population 3,100. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Estevan. Population 2,100. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	77,117	25·2	.....	.....	25·2	.....	39,451	10·3	0·8	7·7	18·8	.....
February	87,678	28·2	.....	.....	28·2	.....	37,607	9·5	0·8	8·6	17·9	.....
March	92,708	29·9	.....	.....	29·9	.....	40,471	12·9	0·7	5·6	19·2	.....
April	89,591	28·9	.....	.....	28·9	.....	36,366	8·6	0·8	7·9	17·3	.....
May	72,964	23·5	.....	.....	23·5	.....	33,258	7·7	0·5	7·6	15·8	.....
June	81,771	26·3	.....	.....	26·3	.....	47,233	13·3	1·2	7·9	22·4	.....
July	81,939	26·4	.....	.....	26·4	.....	Venturi Meter out of order.					
August	77,770	25·1	.....	.....	25·1	.....	No records.					
September	83,896	27·1	.....	.....	27·1	.....	31,166	7·0	0·7	7·1	14·8	.....
October	74,286	23·9	.....	.....	23·9	.....	34,677	8·0	0·6	7·9	16·5	.....
November	78,508	25·3	.....	.....	25·3	.....	31,333	7·9	0·7	6·3	14·9	.....
December	85,312	27·5	.....	.....	27·5	.....	31,387	8·2	0·6	6·1	14·9	.....
Ave. for Yr.	81,962	26·4	.....	.....	26·4	.....	36,293	9·3	0·7	7·2	17·2	.....

1918. — Month.	Kamsack. Population 1,600. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.	Battleford. Population 1,500. Daily Average for the Month.	Per Head for domestic purposes	Per Head for industrial purposes	Per Head for other purposes	Per Head for all purposes	Unaccounted for.
January	166,742	23·5	80·7	.....	104·2	.....	14,194	9·5	.....	.....	9·5	.....
February	154,643	33·0	63·6	.....	96·6	.....	9,643	6·4	.....	.....	6·4	.....
March	145,194	30·6	60·1	.....	90·7	.....	9,677	6·4	.....	.....	6·4	.....
April	158,733	38·5	60·7	.....	99·2	.....	13,067	8·7	.....	.....	8·7	.....
May	158,806	28·2	71·0	.....	99·2	.....	12,645	8·4	.....	.....	8·4	.....
June	162,433	21·9	79·6	.....	101·5	.....	15,133	10·1	.....	.....	10·1	.....
July	112,419	22·7	47·6	.....	70·3	.....	12,581	8·4	.....	.....	8·4	.....
August	134,097	27·1	56·7	.....	83·8	.....	12,258	8·2	.....	.....	8·2	.....
September	139,667	25·7	61·6	.....	87·3	.....	10,667	7·1	.....	.....	7·1	.....
October	164,581	40·6	62·3	.....	102·9	.....	15,226	10·1	.....	.....	10·1	.....
November	180,933	25·5	87·6	.....	113·1	.....	19,200	12·8	.....	.....	12·8	.....
December	202,323	62·3	64·1	.....	126·4	.....	8,387	5·6	.....	.....	5·6	.....
Ave. for Yr.	156,714	31·6	66·3	.....	97·9	.....	12,723	8·5	.....	.....	8·5	.....

Cities and Towns in the Province of Saskatchewan.—Daily Record of Water Consumption in Imperial Gallons.—Concluded.

1918. — Month.	Kindersley. Population 1,000.					
	Daily Average for the Month.	Per Head for domestic purposes.	Per Head for industrial purposes.	Per Head for other purposes.	Per Head for all purposes.	Unaccounted for.
January	22,846	6·4	16·4	.....	22·8	.....
February	23,390	5·8	17·6	.....	23·4	.....
March	26,719	6·2	20·5	.....	26·7	.....
April	27,141	7·1	20·0	.....	27·1	.....
May	13,190	6·5	6·6	.....	13·1	.....
June	13,628	6·9	6·7	.....	13·6	.....
July	10,756	6·8	3·9	.....	10·7	.....
August	7,781	4·8	3·0	.....	7·8	.....
September	9,083	6·1	3·0	.....	9·1	.....
October	7,560	4·5	3·0	.....	7·5	.....
November	8,606	5·6	3·0	.....	8·6	.....
December	8,823	5·9	2·9	.....	8·8	.....
Average for the Year	14,961	6·0	8·9	.....	14·9	.....

Record of Average Daily Water Consumption in Imperial Gallons for Years 1915-1916-1917-1918.

ALBERTA.

Average for the Year.	Per Head Domestic.	Per Head Industrial.	Per Head Other Purposes.	Per Head All Purposes.	Unaccounted for.	Per Head Domestic.	Per Head Industrial.	Per Head Other Purposes.	Per Head All Purposes.	Unaccounted for.	Per Head Domestic.	Per Head Industrial.	Per Head Other Purposes.	Per Head All Purposes.	Unaccounted for.	Per Head Domestic.	Per Head Industrial.	Per Head Other Purposes.	Per Head All Purposes.	Unaccounted for.
	Edmonton.					Lethbridge.					Medicine Hat.					Redcliff.				
1915	46·0	31·0	3·0	80·0	.....	81·4	32·2	1·5	115·1	.....	181	28	15	224	.....	31·1	6·8	.....	37·9	.....
1916	52·5	20·7	5·7	78·9	.....	116·0	41·3	0·7	158·0	.....	214	.....	.....	214	.....	36·8	22·1	1·0	59·9	.....
1917	56·3	25·0	9·7	91·0	.....	95·0	55·0	.....	150·0	.....	257	.....	.....	257	.....	42·5	30·3	.....	72·8	.....
1918	58·0	26·2	10·1	94·3	.....	102·2	44·7	3·0	149·9	.....	.....	.....	.....	264	.....	66·4	22·4	.....	88·8	.....
	Stettler.					Claresholm.					Bassano.					Athabaska.				
1915	.....	.....	.....	.....	.....	37·4	.....	8·2	45·6	.....	6·5	60·2	.....	66·7	.....	14·3	.....	.....	14·3	.....
1916	.....	.....	.....	.....	.....	43·4	.....	9·6	53·0	.....	.....	.....	.....	.....	.....	10·9	.....	.....	10·9	.....
1917	12·0	.....	.....	12·0	.....	56·9	1·9	0·1	58·9	.....	17·9	154·3	95·4	267·6	.....	24·0	.....	.....	24·0	.....
1918	10·7	.....	.....	10·7	.....	72·6	8·7	5·5	86·8	.....	.....	.....	.....	211·0	.....	27·6	.....	.....	27·6	.....
	Carmangay.																			
1915	41·9	.....	2·0	43·9	.....															
1916	32·6	.....	.....	32·6	.....															
1917	31·3	.....	.....	31·3	.....															
1918	29·8	.....	1·0	30·8	.....															

SASKATCHEWAN.

	Regina.					Saskatoon.					Moosejaw.					Prince Albert.				
1915	55·0	7·5	0·1	62·6	.....	21·6	13·9	2·2	45·6	7·9	24·1	4·6	.....	28·7	.....	57·0	.....	.....	57·0	.....
1916	61·1	7·8	.....	68·9	.....	21·0	15·4	1·9	52·6	14·3	35·2	12·3	.....	47·5	.....	55·2	.....	.....	55·2	.....
1917	59·2	12·6	0·3	72·1	.....	24·4	15·6	5·8	66·4	20·6	45·8	13·1	.....	58·9	.....	84·1	.....	.....	84·1	.....
1918	56·9	11·1	0·1	68·1	.....	27·1	17·2	2·4	63·1	16·4	31·6	15·4	.....	47·0	.....	.....	.....	.....	.....	.....
	North Battleford.					Weyburn.					Estevan.					Kamsack.				
1915	6·6	1·3	2·7	14·8	4·2	17·4	.....	0·4	17·8	.....	9·5	7·1	1·5	18·1	.....	.....	.....	.....	.....	.....
1916	9·5	2·0	4·9	22·7	6·3	16·9	.....	0·3	17·2	.....	8·2	5·7	1·0	14·9	.....	.....	.....	.....	.....	.....
1917	10·2	2·2	4·0	23·1	6·7	30·1	.....	.....	30·1	.....	9·7	5·5	4·3	19·5	.....	.....	.....	.....	.....	.....
1918	10·0	4·8	3·0	26·3	8·5	26·4	.....	.....	26·4	.....	9·3	0·7	7·2	17·2	.....	31·6	66·3	.....	97·9	.....
	Battleford.					Humboldt.					Kindersley.					Sutherland.				
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4·9	8·4	1·6	14·9	.....	2·1	.....	0·4	2·5	.....
1916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5·5	26·8	.....	32·3	.....	2·2	.....	0·1	2·3	.....
1917	17·3	.....	.....	17·3	.....	21·5	.....	.....	21·5	.....	5·8	44·4	.....	50·2	.....	1·7	.....	.....	1·7	.....
1918	8·5	.....	.....	8·5	.....	.....	.....	.....	.....	.....	6·0	8·9	.....	14·9	.....	.....	.....	.....	.....	.....
	Scott.																			
1915	.....	.....	.....	.....	.....															
1916	.....	.....	.....	.....	.....															
1917	10·7	34·0	.....	44·7	.....															
1918	.....	.....	.....	.....	.....															

LARGE IRRIGATION PROJECTS.

Eastern Section, C.P.R. Irrigation Block.—No new large construction work was undertaken during the year in this section, although considerable work was done as ordinary maintenance and in enlarging and straightening secondary canals in those districts where a large proportion of the land has been sold and occupied by settlers.

There still remains a considerable block of land in this section which has not yet been finally classified by the department and no further progress in this connection was made during the year. The company sold a great deal of land last year, and has now disposed of a large proportion of the irrigable land already classified which is closest to the railways already constructed.

The year was a very dry one and heavy demands were made for the delivery of water in those areas already settled and under crop. The results shown at our Brooks' experimental station are typical of conditions throughout this section; the dry crops were a practical failure while the irrigated lands produced excellent returns. In the Bassano colony very little water was used and the result was a general crop failure with the notable exception of one or two farmers who, by utilizing the irrigation water, produced bumper crops with splendid financial returns. In the Duchess colony, a few miles north of Brooks, a very general use was made of the water and while the lands were not all well prepared for irrigation, excellent results were obtained. In the Duke of Sutherland colony, lying just north and east of Brooks, there was also a very large general use made of the irrigation water with excellent results. In this colony the settlement is older and consequently the lands are better prepared for irrigation; the results of the more thorough cultivation and preparation were apparent in the crops produced. The company itself undertook to cultivate, seed and irrigate forty acres on each of some twenty-five ready-made farms in the St. Julien colony lying just south of Tilley. The work was started rather late in the season and under such conditions that the best results could not be expected. The lands were all sowed to some kind of grain and all produced a crop. The results were indicative of what might be accomplished during the first season by an energetic settler going on the land in the early spring. Figures submitted by the company covering the whole of this section show that 24,440 acres were irrigated during the season.

Western Section, C.P.R. Irrigation Block.—No new large construction work was undertaken during the year in this section. The usual annual programme of maintenance and betterment was carried out.

The greater part of the land in this section has been sold and settled for a number of years and a large area is under cultivation—mainly in grain crops. The settlers have never made any general use of the irrigation water from year to year, and as a consequence the land has not generally been prepared for irrigation and the smaller ditches have lacked care. When the season developed so extremely dry many of the farmers called for water, and during the height of the irrigation season there was a very heavy demand on parts of the system. The call on the company's operation staff was very great and for a considerable time they were working "night and day" in order to meet all the demands. It is believed that the situation was handled very efficiently, and that a satisfactory delivery was made to all the water users. Figures submitted by the company covering the whole of this section show that 25,191 acres were irrigated.

The Alberta Railway and Irrigation Company.—This company is controlled and operated by the Canadian Pacific Railway Company and is commonly referred to as the C.P.R. Lethbridge section. The city of Lethbridge is the centre to which the tract of irrigated land is tributary.

The season being extremely dry in this district, there was a very heavy demand for water—probably the heaviest in the history of this section. The St. Mary river,

which is the only source of supply tapped by the company's system at this time, was practically dry below the intake of the irrigation canal during the peak load period. During this period a considerable quantity was being diverted out of the river south of the international boundary by the United States Reclamation Service canal.

While for a certain period the whole available supply in the river was being used, the supply at the intake was always sufficient to serve all the lands under the canal. A good deal of difficulty however, was experienced in making proper deliveries of water to the farmers in the eastern end of the section and for a time some of these did not receive a proper supply. The trouble was due to certain of the company's supply canals having become silted up to such an extent that they would not carry a full supply of water. As soon as this became apparent the company's officials made strenuous efforts to overcome the difficulties, and did everything that was possible under the circumstances.

The effort to clean out the silted canals was maintained throughout the irrigation season by operating a floating dredge in the largest of the secondary canals that was affected, and later in the fall after the ditches were dry, a large amount of betterment work was carried out. The canals are now all in shape to make proper water deliveries and it is understood that the company's programme for 1919 contemplates a very considerable expenditure in general betterment work over the whole system.

Figures submitted by the company covering the whole of this section show that seventy thousand acres were irrigated during the season.

Coaldale-Lethbridge Water Users Association.—This association was formed on or about July 3, 1918, with the idea of creating an organization through which the water users, under the Alberta Railway and Irrigation Company's system, could act in unison concerning all matters pertaining to irrigation. There were about seventy-five charter members all representing that part of the system lying to the east of Lethbridge in the district indicated by the name of the association.

The determination to form this association was no doubt brought to a head by the shortage of water referred to in the preceding section of this report, but the necessity of such a course had long been discussed as a means of gaining a proper distribution of the water among the farmers under this system.

The company's system was originally constructed on the old fashioned plan of providing only the main and secondary supply canals and requiring the farmers themselves to construct and operate all the laterals between the company's canals and the fields. Under this system there are many laterals of considerable length serving a considerable number of farmers. With one exception there was no organization among the farmers to provide for co-operative management of the laterals and cause an equitable distribution of the necessary maintenance work or of the water. The result is the same as has always been experienced elsewhere under similar conditions; the laterals are not properly maintained, and the farm at the tail end of the lateral very often goes short of water. Under this condition, certain farms suffer from a shortage of water when a sufficient quantity is being supplied to the lateral from the company's canal. The individual farmer has no means of ascertaining whether the company is making a proper delivery to the lateral or not.

On August 30, Local Union of East Lethbridge No. 141 of the United Farmers of Alberta, became interested in the same matters as were being discussed by the Coaldale-Lethbridge Association and contemplated some separate organization. Finally, however, their activities were directed along the same lines, in creating the organizations, under the Alberta Irrigation District Act, referred to below.

Without trying to describe the evolution of this activity in its proper sequence, the outcome of the various meetings held was a final crystallization of the farmers' views, that the requirement was an organization based on these three primaries; co-operative strength in respect of questions affecting the interests of the company and the interests of the farmers; an organization with full power to control, maintain and

operate the laterals; and an organization with power to make levies of money to cover all necessary expenses. As soon as these ideas became clearly understood it was decided that the best course was the organization of water users' districts under the Irrigation District Act.

The next large question was to decide on a proper division of the system for the formation of the water users' districts. Certain farmers urged the formation of one large district embracing all the territory east of Lethbridge, pointing to the advantage that lay in the great weight one large association would have in discussing questions with the company. Other farmers opposed this idea on the grounds that one large association would be too unwieldy and that possible failure under inexperienced management would wreck the whole movement. Others suggested very small districts, handling only one sub-lateral. Finally a middle course was adopted contemplating the formation of six water users' districts covering the territory east of Lethbridge, each one including from twenty-five to thirty-five sections of land.

From September, 1918, until January, 1919, with a break in December due to the "flu" epidemic, several organization meetings were held under the auspices of the Lethbridge-Coaldale association and with the assistance of the East Lethbridge U.F.A. Local No. 141. At the present time it is understood that all the necessary petitions have been signed calling for the formation of two of the water users districts—to wit, the North Lethbridge district and the Coaldale district. Neither of these districts has yet been formally erected under the Irrigation District Act. In the meantime, the Coaldale-Lethbridge association is acting as a mother organization which it is proposed to maintain until all the water users' districts contemplated are formally erected under the Act.

In the southeast corner of the Lethbridge section the Canadian Pacific Railway Company created a "ready-made farm" colony, comprising about five thousand nine hundred acres. This colony was practically settled in 1917, and during the past season proceeded independently of the Coaldale-Lethbridge association to form a water users' district. This colony was duly erected into the "Ready-made Water Users Irrigation District" on February 18, 1919.

The Canada Land and Irrigation Company.—The following extract is repeated from last year's report: "On July 1, 1917, the Southern Alberta Land Company, the Alberta Land Company, and the Canadian Wheatland Company were amalgamated under the title of the Canada Land and Irrigation Company. Some construction was undertaken late in the season and will be continued in 1918 with a view to being able to deliver water to the first unit of approximately 50,000 acres before the end of the 1918 season."

In the spring of 1918 a considerable amount of work remained to be done before the company could carry water through its canal system to the irrigable lands. The company carried out an energetic programme during the season with a view to completing all this work. By the second week in June the system was in shape to commence delivering water to the Lake McGregor reservoir, and about June 14 the water was first turned into the canal. The remainder of the season was spent in "priming" the section of the canal between the intake and Lake McGregor. The most tedious job was priming the East Arrowwood syphon. This was completed about August 1, and about August 9 the water first reached Lake McGregor. A flow of from fifty to two hundred second-feet into the reservoir was maintained, with but few interruptions, until late in the season. At the end of the season the reservoir had been filled up nearly to the elevation of the bottom of the outlet gates at the south end.

From this point on, the company did a great deal of improvement work on the very difficult section of the main canal which is located on the steep sidehill of the Little Bow river. It also completed the rather heavy cut which the main canal runs into on entering the Little Bow reservoir. At the end of the season the work on the section between Lake McGregor and the Little Bow reservoir had been practically

completed so that the company should be ready to commence carrying water through this section early in 1919. From the Little Bow reservoir on to the first unit of lands to be irrigated, it is understood that the canal is all in good shape.

Speaking generally, the company has completed all the large construction work contemplated for the present, and is now prepared to commence actual operation of the system. It will, however, take practically the whole of the 1919 season to complete the priming of the main canals and during this period a good many difficulties and interruptions may be expected.

The Taber Irrigation District.—The very dry season of 1918 caused a complete crop failure in this district. The farmers all realized what a difference there would have been if their expectations concerning the construction of the irrigation ditch had been realized, and the feeling became very tense. Efforts were made by the district to complete some contract with the Canadian Pacific Railway Company which would bring about immediate construction. No material progress, however, towards actual construction was made during the year.

On February 11, 1919, over four hundred farmers, a very large proportion of whom reside in the Taber district, held a meeting at Taber. An hour was devoted to a discussion of the affairs of the Taber irrigation district, and the discussions which ensued reflected the very strong feeling under which the different speakers were labouring. The principal resolution passed unanimously by the meeting was one asking the Canadian Pacific Railway Company to enter into a contract with the district at such an early date that construction might be carried out during 1919, and water delivered to the land in 1920. Now that the war is over it is confidently hoped that the works for this district will be constructed during 1919.

The Lethbridge Northern Irrigation Project.—The following report, covering some further field reconnaissance and estimates in connection with this project, has been submitted by Mr. V. Meek:—

> "This project has been under investigation by the department since the year 1913, and full reports on the various engineering features and estimates of cost will be found in the annual reports on irrigation surveys for the years 1914-15-16.
>
> "During 1918 the president of the Lethbridge Board of Trade suggested that the system be extended to include the greatest possible area, but that each quarter-section be limited to forty irrigable acres. The idea was to benefit a greater number of people and give each settler a water right to a sufficient acreage to ensure adequate supplies of feed for stock. It was thought that this plan would meet with the approval of the majority of the landowners, and the department was requested to make the further surveys necessary to estimate the cost on the above basis.
>
> "In October, 1918, a reconnaissance was made in the Sundial district to determine the feasibility of extending the canal system across the Little Bow river, and the suitability of the land for irrigation. A report of this work is given in a memorandum to the commissioner dated November 6, 1918, to the effect that the extension is feasible.
>
> "From the information gained on this reconnaissance and preliminary surveys made in the Sundial district in 1914, contour township sheets were prepared, the land was classified and a canal system was projected on which to base an approximate estimate of cost. The Sundial district is shown by the vertical shading east of the Little Bow river on the key plan published with this report.
>
> "In the Iron Springs and Monarch districts, the 1915 estimate was revised, the irrigable area being reduced to forty acres in each quarter-section, and the canal capacities reduced accordingly. This district is shown by the diagonal

shading on the key plan. The system was also extended to include the Barons and Carmangay districts as originally estimated in the 1914 report. This district is shown by the vertical shading west of Nobleford and surrounding Barons and Carmangay on the key plan. The main canal was redesigned as to size and the location changed to include the Keho Lake reservoir, as shown on the accompanying plan. The advantage in using this reservoir is that by drawing water from Keho lake for the maximum draught period of the irrigation season, the main canal from the intake to the reservoir can be reduced in capacity from 1,170 second-feet to 870 second-feet. The method of using and storing the water is clearly shown on the accompanying hydrograph of the Oldman river for the year 1918.

"North of Oldman River

Department of the Interior

RECLAMATION SERVICE

IRRIGATION DIVISION

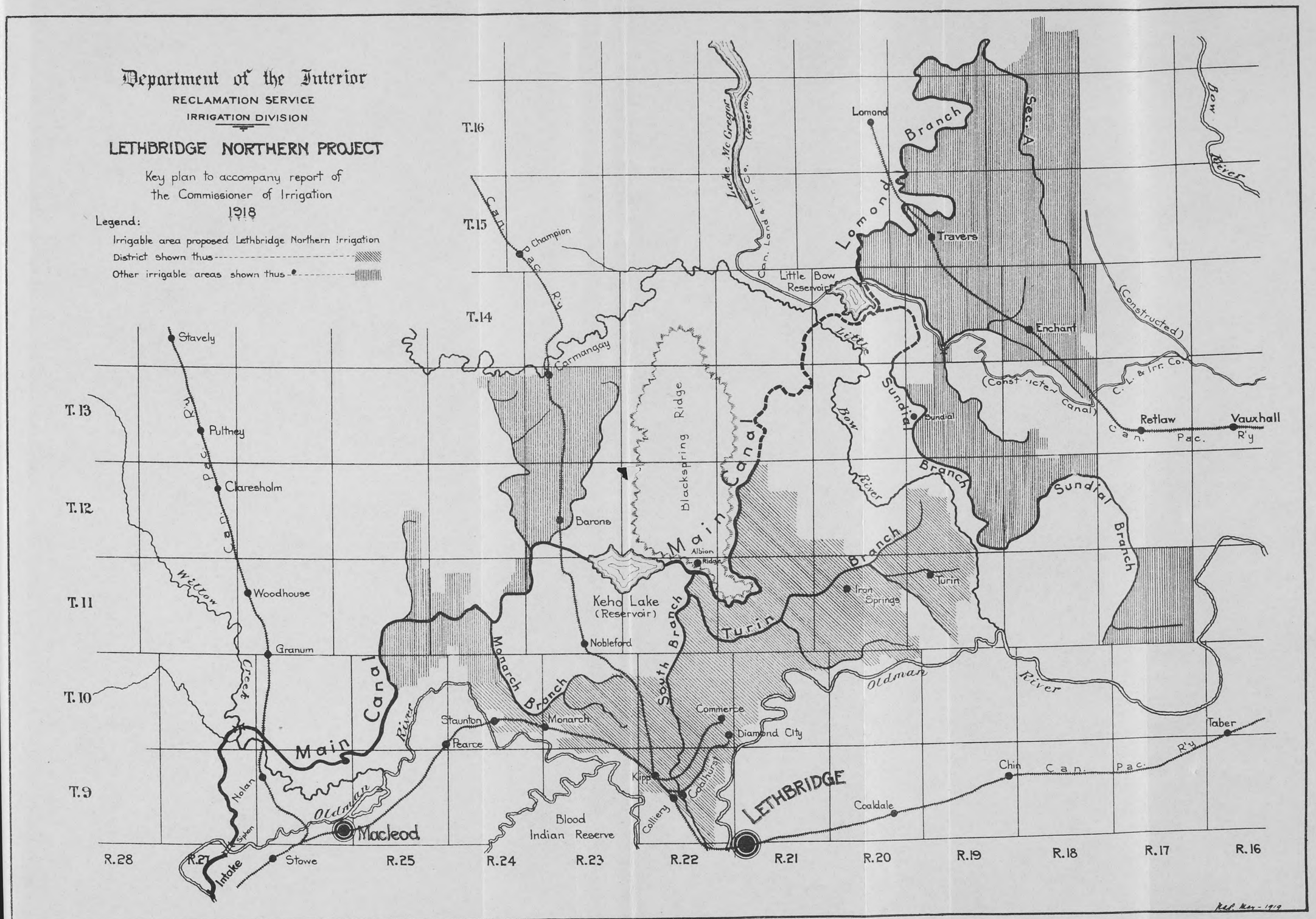
LETHBRIDGE NORTHERN PROJECT

Key plan to accompany report of
the Commissioner of Irrigation
1918

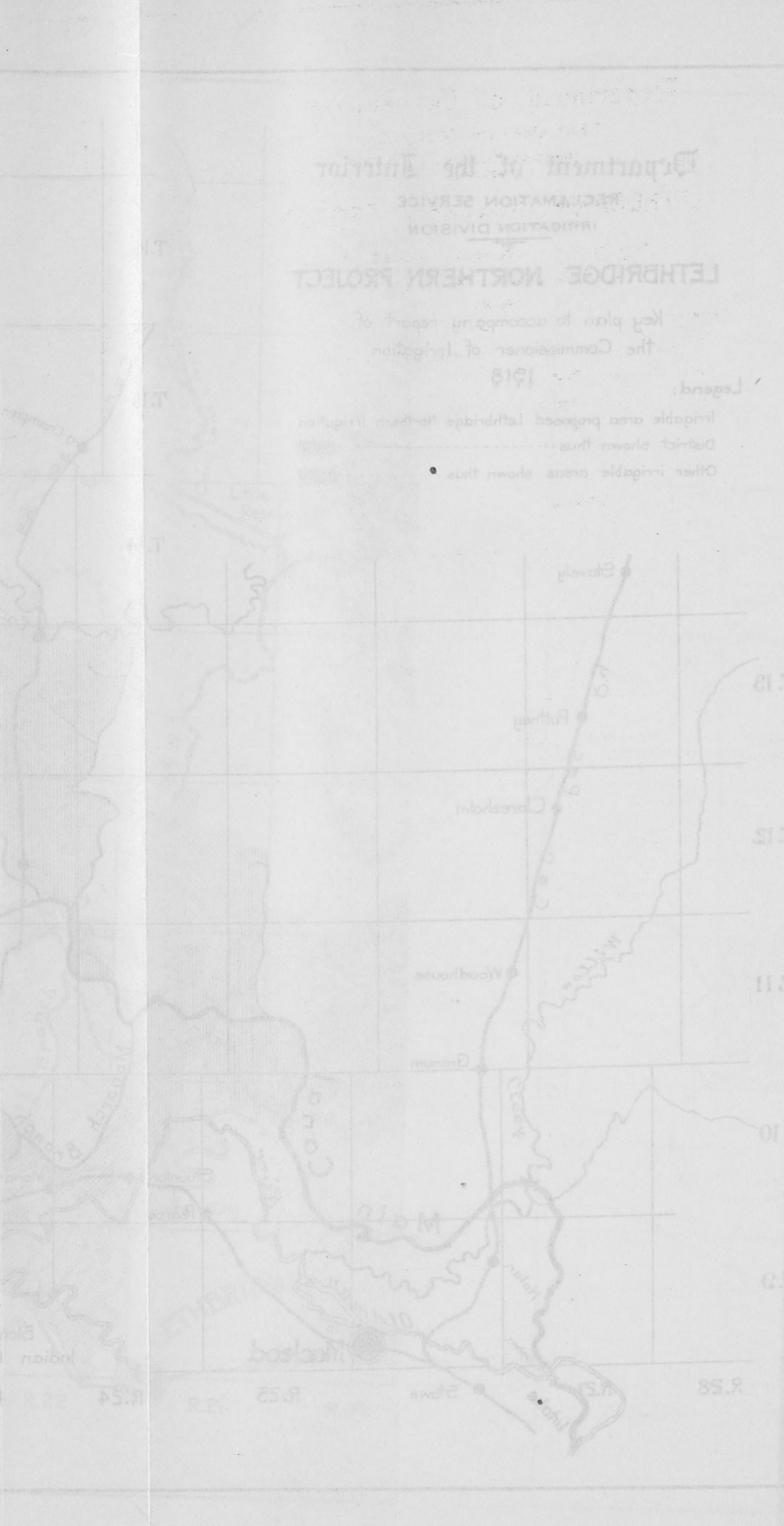
Legend:

Irrigable area proposed Lethbridge Northern Irrigation District shown thus

Other irrigable areas shown thus



Ref. Map - 1919



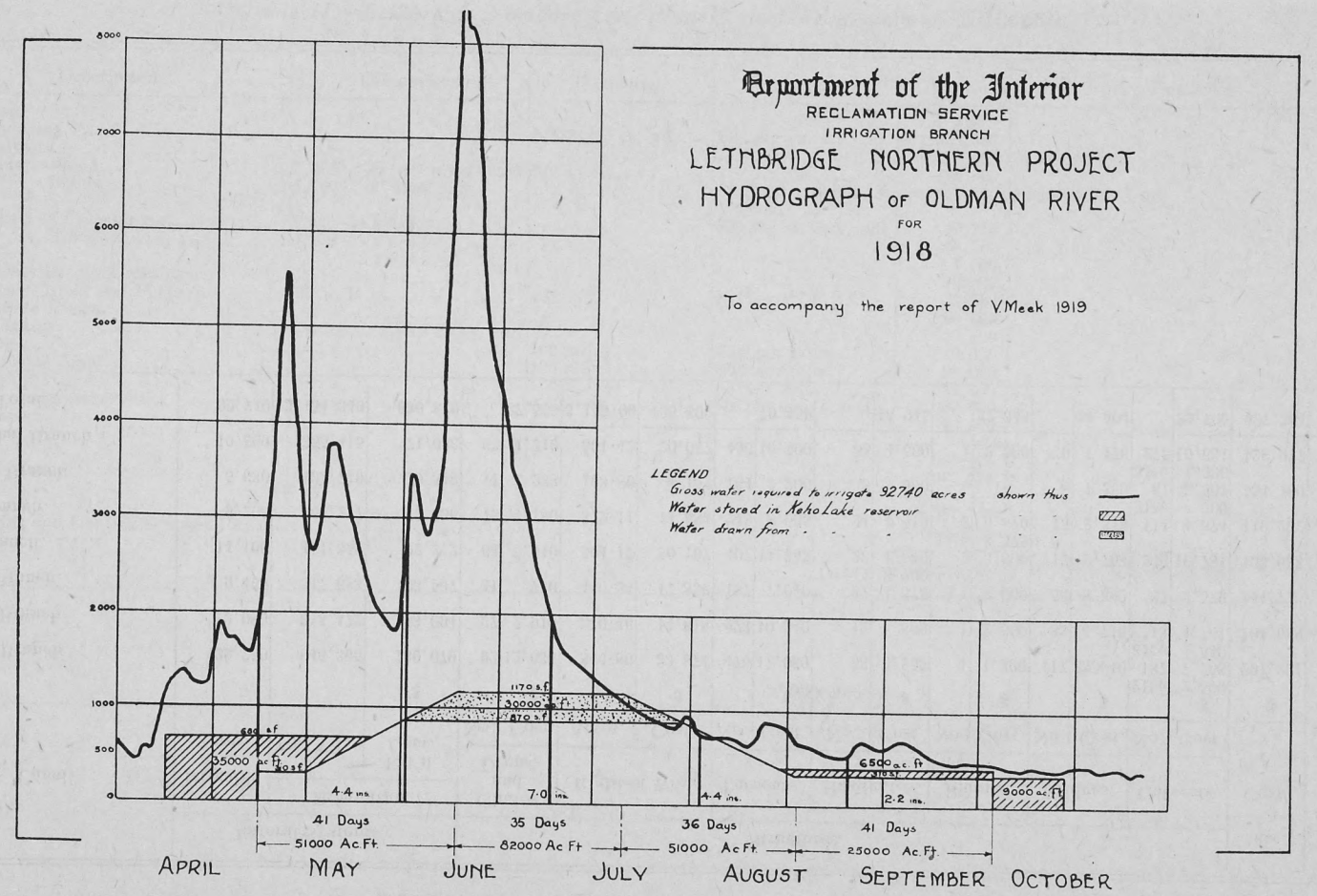

Department of the Interior
RECLAMATION SERVICE
IRRIGATION BRANCH
LETHBRIDGE NORTHERN PROJECT
HYDROGRAPH of OLDMAN RIVER
FOR
1918
To accompany the report of V.Meek 1919
LEGEND
Gross water required to irrigate 92740 acres shown thus
Water stored in Keho Lake reservoir
Water drawn from
8000
7000
6000
5000
4000
3000
2000
1000
500
0
1170 s.f.
30000 ac. ft.
870 s.f.
690 s.f.
35000 ac. ft.
405 s.f.
4.4 ins.
7.0 ins.
4.4 ins.
2.2 ins.
6500 ac. ft.
9000 ac. ft.
41 Days
51000 Ac.Ft.
35 Days
82000 Ac Ft
36 Days
51000 Ac Ft.
41 Days
25000 Ac.Ft.
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

Table I.—Lethbridge Northern Irrigation Project

Canal.	Lateral Systems.			Structures.														Cost.	Cost per Acre.
	Irrigable Area. Acres.	Excavation.		Chutes and Drops.		Right of Way.		Turnouts.		Headgates.		Flumes.		Bridges.		Culverts.			
		Cu. Yds.	Est'd. Cost.	No.	Cost.	Acres.	Cost.	No.	Cost.	No.	Cost.	No.	Cost.	No.	Cost.	No.	Cost.		
			$		$		$		$		$		$		$		$	$	$
Lomond Branch	22,750	945,395	189,079	92	12,635	846·86	33,874	476	17,050	53	3,255	1	1,200	117	23,940	2Ry 187 3Ry	2,500 7,758	291,291	12·80
Retland Branch	12,080	315,472	63,094	27	2,910	370·46	14,818	273	10,340	12	800	1	2,500	32	4,715	113	550 4,761	104,688	8·72
Sundial Branch	9,460	517,683	103,537	41	770	446·24	17,850	197	7,040	27	1,575	1	3,000	56	8,392	87	2,579	144,743	15·30
Turin Branch	14,106	461,358	92,272	64	5,610	504·17	20,167	407	14,355	DivG 23	3,200 1,540	2	3,000	17	2,708	246	10,781	153,633	10·85
South Branch	9,205	361,277	72,256	75	4,180	372·11	14,884	248	8,965	24	1,515	3 sin 2	3,375 6,870	15	2,373	114	4,874	119,292	12·95
Monarch Branch	5,630	197,749	39,549	11	238	103·80	4,152	164	5,200	8	500	....	.....	8	1,280	2Ry 81 3Ry	300 3,561 1,500	54,780	9·74
Main Canal Branch	19,509	355,415	71,083	63	1,210	501·42	20,057	456	16,500	55	4,560	1	2,200	9	1,176	275	10,631	128,917	6·50
Total	92,740	3,154,349	630,870	....	37,553	3,145·06	125,802	....	79,450	.....	16,945	....	22,345	....	44,604	....	39,795	997,344	10·70

Table II.—Lethbridge Northern Irrigation Project.—Summary of Estimates.

Description.	Dimensions.	Quantities.	Unit Costs.	Cost.	Remarks.
Main Canal—				$	
Excavation		5,433,225 cu. yds.	25c. per cu. yd.	1,358,307	
Headworks				98,600	
Siphons—Wood	3,375′–1–10′ 8″ wood stave	870 s.f.		125,000	
" Steel	3,200′–5·6′ steel pipe		Steel 10c. per lb. in place.	71,300	Includes 42′ drop.
Flumes—Willow Creek	2,930′–14 x 6·8		$50 per M. and haul.	40,116	
Rocky Coulee	4,100′–14 x 5·8		" "	66,702	
	12 x 5·0		" "	7,900	
Railway Bridge Crossings				12,000	
Bridges, Road and Farm	15′ wide	108	$55 per M. F.B.M.	52,000	
Concrete Drops				50,000	
Headgates	Outlet to Keho Lake, etc.			25,000	
Fencing		100 miles	$300 per mile	30,000	
Telephone Line		120 miles	$200 per mile	24,000	
Right of Way		1,322 acres	$40 per acre	52,900	
Keho Lake Reservoir		3,600 acres	$10 per acre	36,000	
Drainage				50,000	
				2,099,825	
Lateral System				997,344	
				3,097,169	
Engineering and Contingencies at 15%				464,575	
				3,561,744	÷ 92,740 = $38.40 per acre.

Table III.—Lethbridge Northern Irrigation Project.—Summary of Estimates—Cost excluding Sundial District.

Description.	Dimensions.	Quantities.	Unit Costs.	Cost.	Remarks.
Main Canal—				$	
Excavation		2,940,000 cu. yds.	25c. per cu. yd.	735,000	
Headworks				98,600	
Siphon	3,375′ 1-9′-6″ wood stave.	650 s.f.		105,000	
Flumes				90,000	
Railway Crossings		2		10,000	
Bridges		70	$500	35,000	
Headgates				20,000	
Fencing		80 miles	$300	24,000	
Telephone		65 miles	$200	13,000	
Right of Way		717 ac.	$40	28,680	
Drainage				25,000	
				1,204,280	
Lateral System				456,600	
				1,660,880	
Engineering and Contingencies at 15%				249,100	
				1,909,980	÷ 48,450 = $39.50 per acre.

"The duty of water used in this estimate was 1·5 acre-feet per acre for the irrigation season on the whole irrigable area. An irrigation factor was not included as it is considered in a dry year on the forty-acre basis practically the whole area could be irrigated.

"The net capacity of canals was fixed at one second-foot per one hundred and twenty acres of irrigable land, which is sufficient to allow one irrigation six inches deep over fifty per cent of the total area in fifteen days. This is probably a safe estimate on the assumption that the other fifty per cent would be under alfalfa and would not have this fifteen-day critical period assumed for grain and root crops.

"The absorption losses were estimated at the average rate of six cubic feet per second per million square feet of wetted area. The total loss for the system amounts to thirty-four per cent of the gross water diverted at the intake. The loss is heavier for this forty-acre scheme on account of the greater length of canal required per acre irrigated.

"A tabulated summary of the estimates accompanies this report.

"Table I gives the total cost of the lateral system under each branch, including the branch, and also the total irrigable area under each branch.

"Table II gives an itemized summary of the cost of the main canal and structures from the intake to the division gate at the Lomond branch. The total irrigable area is 92,740 acres and the estimated cost $3,561,744 or $38.40 per acre.

"Table III has been added for comparison purposes and gives an approximate estimate of cost on the same forty-acre basis, but excluding the Sundial district. The total irrigable area is then 48,450 and the cost $39.50 per acre. It shows that by excluding the Sundial district, the cost is decreased $1.10 per acre.

"The following unit prices were used in the above estimate:—

Earthwork	Main canals, an average of 25 cents per cubic yard. Laterals, an average of 20 cents per cubic yard.
Timber in place	Large structure, $50 per F b.m. plus an allowance of 40 cents per ton mile for haul. Small structures, $55 per M b.m.
Piles	50 cents per lin. ft. in place.
Reinforced concrete	$30 per cubic yard.
Steel	10 cents per lb. in place.
Fencing (double fence)	$300 per mile.
Telephone line	$200 per mile.

"The above prices are somewhat higher than those used in the 1915 estimate, but not as high as present prices. It is impossible to foretell what prices will be at some indefinite time in the future when this project may be constructed, but it is not reasonable to assume that the present abnormal economic conditions will continue for any great length of time, and hence a scale of prices has been adopted which may be expected to prevail within one or two years."

The interest taken during the winter of 1918-19 in irrigation development by the farmers in the south country is referred to more particularly in the following sections of this report. This interest was very keen indeed in the district north of the Oldman river and between Monarch and Turin. Irrigation meetings were held on February 19, 20 and 21, 1919, at Turin, Coalhurst and Monarch with respective attendances of one hundred and thirty, eighty and seventy, farmers. These meetings were all strongly in favour of irrigation, with the partial exception of the meeting at Monarch were the members of a colony of Hollanders surrounding this town were opposed to irrigation development.

During the winter there was no interest displayed in irrigation development with a view to having this project extended either in the Barons-Carmangay district or in the Sundial district.

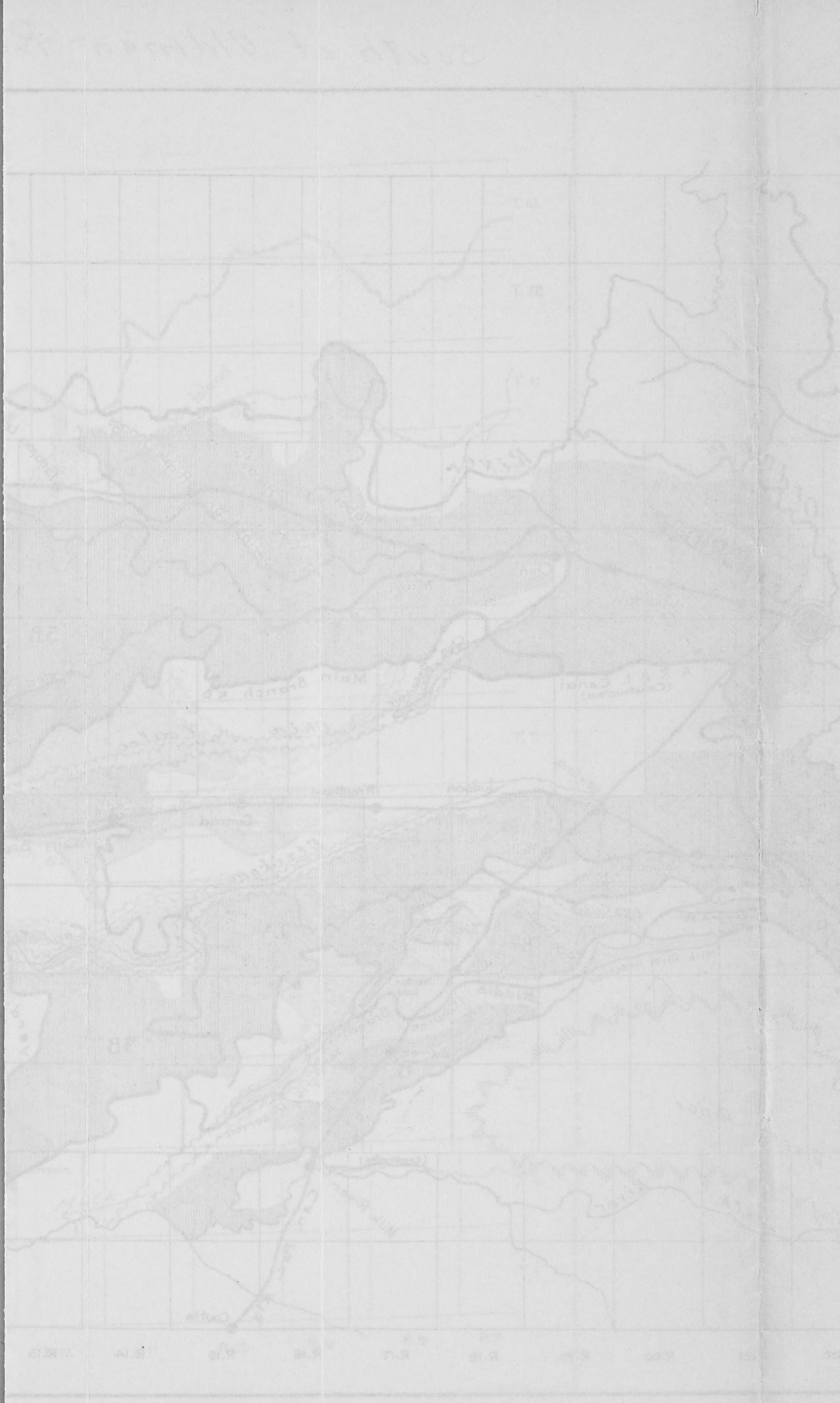
On March 27, 1919, at Lethbridge a committee representing the landowners under the Lethbridge Northern project decided to proceed immediately to petition for the erection of the Lethbridge Northern Irrigation District under the Provincial Irrigation District Act of 1915. The area to be included in this district is that shown by the diagonal shading in the key plan accompanying Mr. Meek's report above. A start was made during the first week in April to circulate the necessary petitions in this respect, but it is not known at the time of writing this report, whether or not the petitions have been completed and submitted to the proper provincial authorities.

The Lethbridge Southeast Irrigation Project.—This project has previously been referred to as the Milk and St. Mary Rivers Project, but the name now adopted seems to give a better idea of the geographical location and is therefore more desirable. No work has been done on this project during the year, other than a new office study of the question of water supply from the several original sources which it is proposed to tap, and the various incidental office studies that were made concerning special inquiries made by interested landowners in different sections under the proposed projects. The great interest which developed during the past winter urging the development on the part of the landowners is described in the next section of this report.

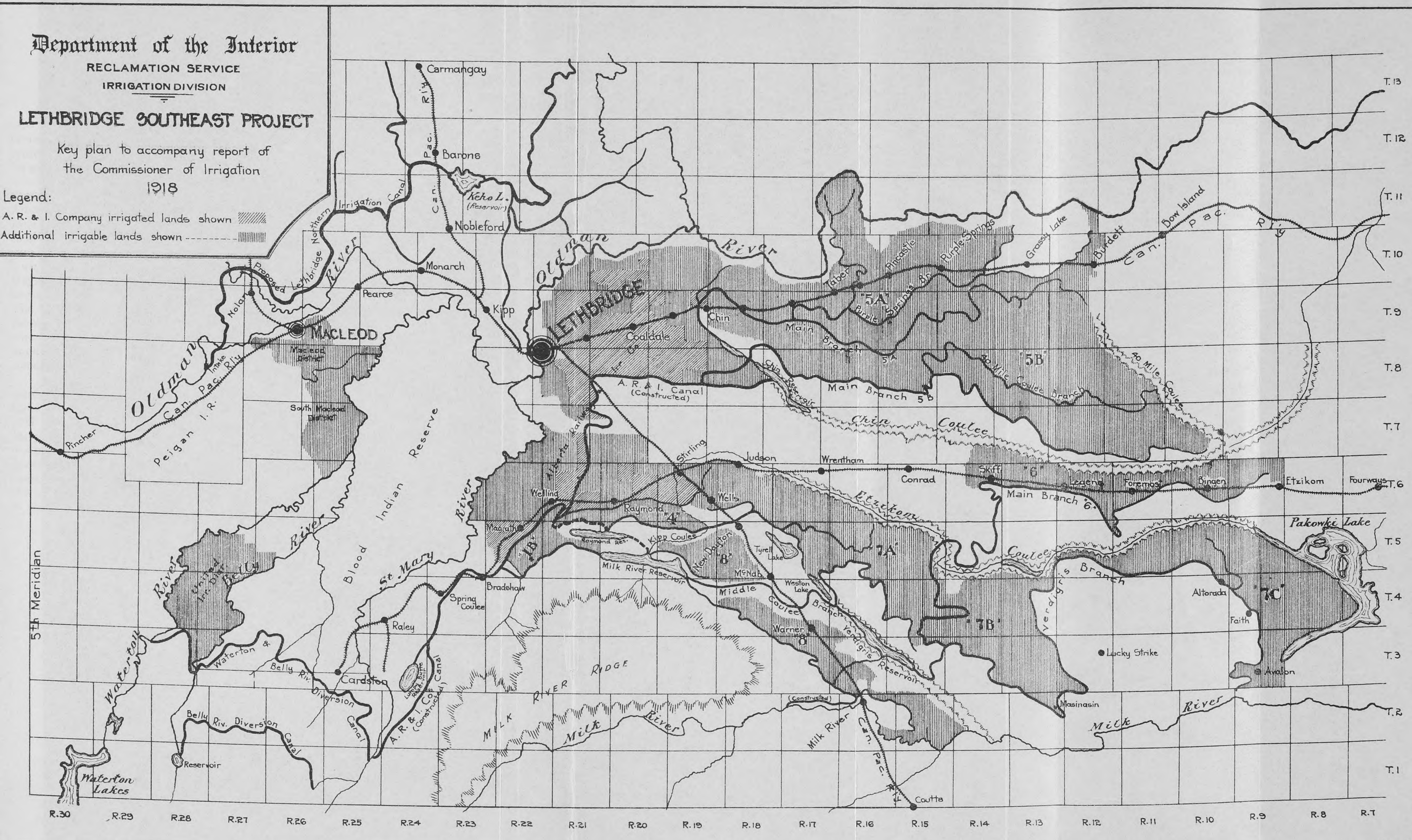
During the winter petitions in favour of this development were received signed by five hundred and sixty-one owners, and representing fourteen hundred and sixty-six quarter-sections of land. This indicates the very widespread interest that developed, but must not be accepted as representing the full measure, because in many of the districts the petitions were not completely circulated. The accompanying key plan will indicate the very large district that is affected by this proposed development.

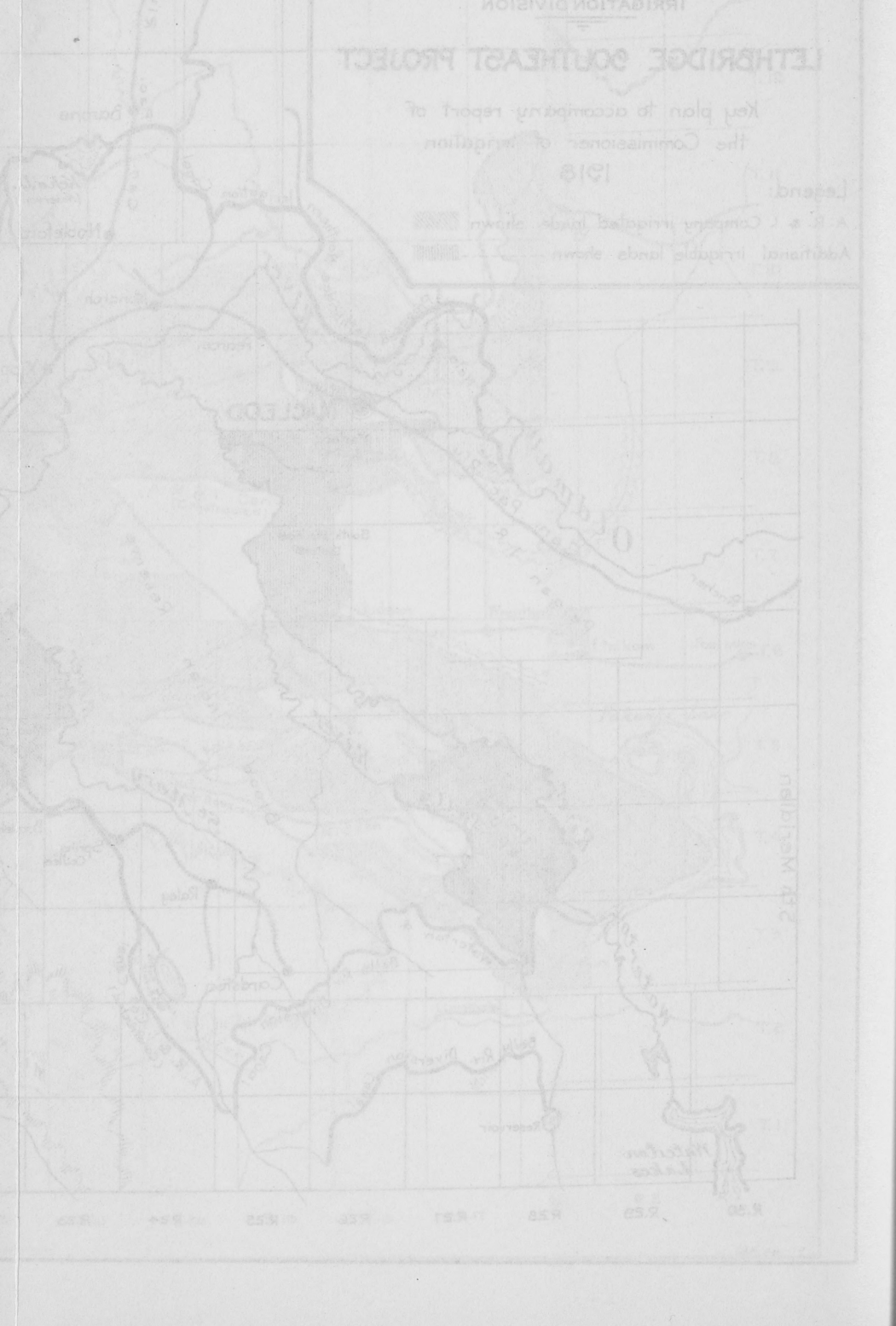
The Irrigation Development Association.—This association was formed at Lethbridge on March 14, 1919, following the general irrigation meeting held at Lethbridge on the same day where the following resolution was passed:—

> "That for the proper continuance of the important work initiated at this conference of farmers and business people from the district within eighty to one hundred miles radius of Lethbridge, there should be formed the Irrigation Development Association, with an executive as follows: Chairman, vice-chairman, secretary-treasurer, and twenty-five others, with power to add to their number.
>
> AIMS AND OBJECTS.
>
> "1. To further the use of irrigation water from our mountain streams for the stabilization of our farming operations and for the steadying from year to year of our business operations.
>
> "2. To aid in the organization of irrigation districts.
>
> "3. To maintain connections between our farmers and the Dominion Government and the Alberta Government to these ends, and to secure the assistance of these Governments, financial and otherwise, for the furtherance of the work of the association.
>
> "*Membership.*—To be open to all interested farmers and business men on an annual membership fee of $2, of which $1.50 will be subscribed to the main association, and fifty cents to each respective local association.
>
> "*Meetings.*—Meetings of the executive to be held not less than once in every three months, and a general meeting at least once a year.
>
> "*Central office.*—The headquarters and central office of the association to be established at Lethbridge.
>
> *Local associations.*—Macleod, Monarch, Barons and Carmangay, Coalhurst and Commerce, West Lethbridge, Iron Springs, Turin, Sundial, Grassy Lake,



South of Oldman River.





Bow Island and Purple Springs, Taber, Barnwell, Chin, Coaldale, Foremost, Etzikom and Nemiskam, Wrentham, Stirling, Raymond, Magrath, Cardston, Glenwood and Hill Springs, Milk River, Warner, New Dayton, Masinasin, Altorado."

It will be noted from the local associations named that the membership of this association embraces all the districts which will be affected by all the new irrigation projects now contemplated in Southern Alberta, namely: The Lethbridge Southeastern project, the Lethbridge Northern project, the Taber Irrigation District, the Macleod Irrigation project, and the United Irrigation District.

The formation of the Irrigation Development Association was the outcome of a very marked movement which had taken place amongst the farmers in Southern Alberta during the winter in favour of irrigation development. Several distinct projects are contemplated, but the formation of this association was for the union of all local interests for the advancement of the common interest of the south country.

During the winter irrigation meetings were held at fifteen different points as follows, in the order in which the meetings were held. Macleod, on December 20, 1918; Raymond, Magrath, Taber, Foremost, Etzikom, Milk River, New Dayton, Turin, Coalhurst, Monarch, Bow Island, Burdett, Lethbridge and Warner on March 15, 1919. The total attendance at these meetings was over twenty-four hundred. The most conspicuous meetings were at Raymond, where the attendance was three hundred; at Taber where the attendance was four hundred and fifty; and at Lethbridge, where nearly four hundred and fifty delegates registered with probably seven hundred in attendance at some time during the all-day meeting.

The question must naturally arise, what was the reason for this very marked movement? This question can best be answered by recalling that over practically all of the country affected by the contemplated developments there was a very lean crop in 1917 and a crop failure in 1918, both due entirely to drought. In the same districts the past ten years have produced only three good crops, due to the same cause. Then the moral effect of the great war and the national call to the farmers for greater production caused most men to take stock of their surroundings. Think of these conditions, and then read the story told to the farmers by W. H. Fairfield, of the Dominion Government Experimental Farm at Lethbridge, and see the chart which he exhibited to them.

Lethbridge Experimental Station.—Comparative Results of Crops Grown on Dry and Irrigated Land.—Yield in Bushels per acre.

—	1908.		1909.		1910.		1911.		1912.		1913.		1914.		1915.		1916.		1917.		1918.		Average.		Increase due to Irrigation.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Bush.	%
Wheat—																										
Marquis.....	29	43	31	40	11	23	Hailed.		28	50	25	52	24	54	63	94	48	71	28	48	14	62	30	53	23	77
Oats—																										
Banner.....	80	88	56	77	21	68	Hailed.		77	145	73	115	49	113	143	81	118	157	56	128	24	104	70	108	38	54
Barley—																										
Swedish Chevalier.	55	61	44	69	12	54	Hailed.		41	77	50	93	25	90	86	80	64	79	40	82	17	91	43	78	35	81
Peas—																										
All varieties.	19	19	19	19	12	33	23	39	41	62	31	42	19	52	53	50	46	37	23	48	16	48	27	41	14	51
Potatoes—																										
Irish Cobbler	92	235	159	605	103	521	356	568	296	501	195	483	400	495	283	447	475	530	157	465	93	505	237	487	250	105

Quoting Mr. Fairfield very briefly, he explained the chart above as follows:—

> "The experimental farm is bisected by an irrigation ditch so that a part of the farm is above the ditch and is dry farmed and a part is below the ditch and is irrigated. The figures shown in the chart have been very carefully selected, showing the actual results gained during the past eleven years on crops where the only difference was between dry land and irrigated land. There was no special attempt made to get results that would show the difference between dry land and irrigated land—the aim was to develop methods for gaining the best results, both on dry and on irrigated land. The crops were grown on small plots under very careful cultivation, so that all the yields are probably higher than produced on the average farm; but the *difference* between the yields should be the same as on an ordinary farm. The last column speaks for itself in showing the average increase over eleven years—some wet and some dry—due to irrigation. And further all the dry crops were produced on summer-fallow, which requires that for every acre producing a crop in any year another acre is lying fallow. The irrigated land produced a crop under rotation every year. Therefore to get a true comparison between the dry and the irrigated land the figures in the last column should all be doubled. And again, the chart makes no mention of alfalfa or the hay crops which are, perhaps, the most profitable of all on the irrigated lands. There can be no comparison made, because neither alfalfa nor dry grasses can be grown commercially on dry land. The average farmer in the Coaldale district (east of Lethbridge) on irrigated land produces about three and one-half tons of alfalfa per acre each year."

Macleod Irrigation Project.—This project was previously surveyed with reference to some nine thousand five hundred irrigable acres lying directly south of Macleod and a report was submitted in 1916-17. The active interest in irrigation during the winter included the landowners in the strip of smooth country south of Macleod between the rough breaks of the Ridge Between the Rivers and the Waterton and Belly rivers, and running to a point near Ewelme.

The irrigation of this new area contemplates a diversion from the Waterton river, either direct or through the works of the United Irrigation District. A very brief reconnaissance was made in the field during the winter in this connection, and it is probable that a direct diversion would be very difficult and expensive. It has also been stated that it is feasible to tap the Oldman river at Brocket, run down to a mile south of Chokio and then by taking advantage of a depression in the country, bring a canal through the Ridge Between the Rivers and thus command all of the irrigable area lying to the south of Macleod. We have not as yet made any reconnaissance to test the feasibility of this route.

During the winter approximately one-third of the landowners who would come under the proposed canals signed petitions in favour of irrigation development. The location of this district is shown by the shaded areas south of the town of Macleod on the key plan of the Lethbridge Southeastern project which has been published with this report.

Magrath-Raymond-Stirling Irrigation District.—The organization meeting for this district was held at Raymond on February 15, 1919. It was attended by representative men from Raymond and Magrath.

The feeling of the people in this district is this: They are keenly interested in the early development of the complete Lethbridge Southeastern project, and will do everything in their power to forward this project. On the other hand, they are crying for more irrigation water, and lest the complete project be not constructed in the near future, they have decided to organize now so that they will be prepared to carry on such construction as will allow of the irrigation of every acre in the district that is not now being served by the Alberta Railway and Irrigation Company's canal.

Reference to the map showing the second system of canals accompanying the report in 1915 on the Milk and St. Mary project will show tracts 1-B and 4 lying above the present Alberta Railway and Irrigation canal, with irrigable areas of 4,096 acres and 6,770 acres respectively. And further, there are shown tracts 1-A and 2 containing 20,440 irrigable acres and 31,700 irrigable acres respectively, wherein only a small portion of the irrigable areas are at present supplied from the Alberta Railway and Irrigation canal. The idea of the formation of the irrigation district is to provide for the irrigation of the irrigable lands lying above the Alberta Railway and Irrigation canal, and also to supply the irrigable land lying below the canal which is not at present supplied and for which land no water rights can be obtained by the farmers at the present time from the Alberta Railway and Irrigation Company.

The owners of practically all the lands in this district have already petitioned for the development of the Lethbridge Southeastern project, and the great majority are no doubt in favour of further irrigation development. Up to the time of writing this report the irrigation district has not been formally erected, and it is not known whether the special petitions required have been signed and submitted.

The United Irrigation District.—The lands which comprise this proposed district lie between the Belly and Waterton rivers and originally comprised the old Cochrane ranch. They are now owned by the Alberta Stake of Zion Mormon Church which purchased the land and then colonized it. The location of the district is shown on the key plan of the Lethbridge Southeastern project which is published with this report.

In July, 1906, the Alberta Stake of Zion made application for the irrigation of this district but at that time contemplated a water supply from the Waterton river. After making surveys and estimates of the project the scheme was dropped on account of the high cost of diverting the water from the Waterton river. In March, 1919, the Alberta Stake made a new application on behalf of the United Irrigation District, contemplating a water supply from the Belly river. No final plans are available as yet, but it is known that the diversion from this source will be very cheap, as in fact will be the whole project as now contemplated.

The lands affected comprise a total area of about 67,500 acres. At the time of writing this report the necessary petition for the erection of the Irrigation District has been circulated and very largely signed but the district has not yet been formally erected.

DUTY OF WATER AND IRRIGATED CROP REPORTS FOR 1918.

The study of the question of the proper duty of water requires the collection of a great deal of detailed information and then a very careful study of all the data available. A complete report containing all the data collected has been submitted separately but owing to its bulk will not be published. This summary report outlines the scope of the work which was carried out and deals briefly with the more interesting features.

Work was continued at the Strathmore demonstration station, but owing to the shortage of help it was not found possible to keep a record of the water applied but only of the crops produced. Experimental plot work was carried on this year for the first time at Brooks and was continued as during the past years at Ronalane. Data regarding the duty of water were collected at Coaldale and irrigated crop reports were submitted by the inspecting engineers for the Cypress Hills district, mainly in Saskatchewan, and for the Macleod district in Alberta.

The work was carried on under the general supervision of Mr. W. H. Snelson who, due to the lack of qualified assistants, devoted the greater part of his time to directing the work at the Brooks station. Mr. E. E. Eisenhauer collected the data in the Coaldale district. Mr. S. Hansen, of the Canada Land and Irrigation Company, operated the plots at Ronalane. Mr. W. Auld, of the Canadian Pacific Railway Company operated the demonstration station at Strathmore.

Demonstration Station, Strathmore, Alberta, 1918.

The season of 1918 was very dry. The precipitation from April to September was only 0·48 foot or nearly three inches less than 1914. Comparison with Calgary records indicates that the season was as dry as any that has been experienced since 1885 and drier than any since 1892. The outstanding feature of the season was the very small precipitation with a high mean temperature and a good deal of wind, causing a maximum of evaporation and plant transposition.

The results of the season's work were unsatisfactory because it was not found possible to obtain records regarding the definite quantity of water applied to the various plots, but the following summary will give an idea of the results that were obtained. Three wheat plots totalling 3·95 acres were irrigated twice, receiving a total depth of water (irrigation plus precipitation) of about 1·5 feet, and yielded from thirty-four to forty-seven bushels per acre. Two oat plots totalling 3·23 acres were each treated differently, one being irrigated once and receiving a total depth of water of about one foot, and the other being irrigated twice and receiving a total depth of water of about 1·5 feet. Both plots appeared to be affected by some disease which influenced the yield, and both gave nearly the same yield of 45 to 46 bushels per acre. Another plot of oats seeded on July 3 was irrigated once and yielded 2·5 tons per acre of green feed. One plot of field peas covering four acres was irrigated once receiving a total depth of water of about one foot and yielded only 14·7 bushels per acre. This plot was in grain for the preceding two years and the surface soil contains a large percentage of alkali. One plot of barley covering 2·23 acres was irrigated once receiving a total depth of water of about one foot and yielded twenty-six bushels per acre. This plot is composed of sandy soil which drifts badly.

A plot of alsike clover covering 1·25 acres was seeded in 1917 and a very good stand obtained. During the winter of 1917 about fifty per cent of the stand winter killed. This year the plot was irrigated once receiving a total depth of about one foot and yielded 2·22 tons per acre. A plot of red clover covering 1·87 acres was seeded in 1917 and a good stand obtained. In the spring of 1918 it was noted that about thirty per cent of the stand had winter killed. The plot was irrigated once, receiving a total depth of about one foot and yielded, under two cuttings, 3·02 tons per acre. There was no old alfalfa on the station this year.

The potato plot covered one-third acre, was irrigated once and only produced 176 bushels per acre, the crop being damaged by rhizoctonia and blackleg. A plot of Cassia Flint corn covering one-third acre was irrigated once, cut for silage on September 17, and yielded 7·5 tons per acre. A plot of Halls Westbury turnips covering one-third acre was irrigated once and yielded fifteen tons per acre.

The results gained at the Strathmore station from year to year have indicated that the grasses are perhaps the most favourable crops to irrigate in this district, and therefore the results gained on these crops will be dealt with at a little greater length. A plot covering 3 acres was sown down with a hay grass mixture in June, 1917, and a good stand obtained. The mixture used was 2 pounds alsike clover and 4 pounds each of brome, western rye, timothy, meadow fesque and orchard grass, making a total of 22 pounds per acre. The plot was irrigated in 1917 and yielded one cutting of about one-half ton to the acre, with a growth of from eight to ten inches left uncut in the fall. The plot was irrigated twice this year receiving a total depth of water of about 1·5 feet. It was cut twice and yielded 4·18 tons of hay per acre. The orchard grass in the mixture did not do very well and might be replaced with advantage by meadow foxtail. A plot of western rye grass covering about one-half acre was seeded to a good stand in July 1917. This year the plot was irrigated twice receiving a total depth of water of about 1·5 feet and yielded 2·69 tons per acre.

The following table shows the results gained over a period of five years on four plots of grass each one acre in extent. The mixed plot contained a mixture of western rye, timothy and brome. The plots were sown side by side and became badly intermingled so that this year the four plots were cut as one.

Year.	Mixed Grasses.		Brome Grass.		Western Rye.		Timothy.		Remarks.
	Yield in tons per ac.	Total Depth Rec'd.	Yield in tons per ac.	Total Depth Rec'd.	Yield in tons per ac.	Total Depth Rec'd.	Yield in tons per ac.	Total Depth Rec'd.	
1914	Seeded	1·04	Seeded	1·04	Seeded	1·04	Seeded	1·04	Irrigated once 4-inch.
1915	2·37	1·44	3·14	1·44	2·04	1·44	3·66	1·44	Not irrigated.
1916	3·84	1·33	2·84	1·33	2·76	1·33	1·75	1·33	Not irrigated.
1917	1·37	0·85	1·65	0·85	1·36	0·85	1·06	0·85	Not irrigated due to labour shortage.
1918	1·06	1·50	1·06	1·50	1·06	1·50	1·06	1·50	Two 6-inch irrigations.
Average	2·16	1·23	2·17	1·23	1·81	1·23	1·88	1·23	

In 1916 three plots of brome, western rye and timothy respectively were sown down on very alkaline land in order to test the comparative tolerance of these three grasses for alkali. Each plot contained about one-half acre. In 1917 the brome produced 0·67 ton per acre, the western rye 1·58 tons, and the timothy 0·51 ton. In 1918 the brome produced 1·93 tons per acre, the western rye 3·39 tons and the timothy 2·38 tons. This test shows the western rye to be the best alkali resistant of the three grasses. These plots have tile under drainage and the increased yields in 1918 are probably due to the removal of the alkali by the tile drains since 1917.

A good deal of interest has been displayed from time to time concerning different varieties of grasses that might be grown successfully in this district, and the following short outline of an experiment made at this station may therefore be of interest. Twenty-one varieties of grasses were seeded in May, 1916, as detailed below, with the idea of determining which varieties would prove most hardy under the climatic conditions peculiar to the Strathmore district. These grasses were planted in single rows five feet long. Cultivation was maintained between the rows to keep down weeds and check the spreading of some of the root-creeping grasses.

Brome Grass.	Rhode Island Bent Grass.	Sweet Vernal Grass.
Meadow Fesque.	Wavy Mt. Hair Grass.	Rough Stalked Meadow Grass.
Meadow Foxtail.	Creeping Bent Grass.	Tall Oat Grass.
Woodmeadow Grass.	Tall Fesque.	Italian Rye Grass.
Hard Fesque.	Various leaved Fesque.	Orchard Grass.
Red Fesque.	Smooth Stalk Meadow Grass.	Perennial Rye Grass.
Sheep Fesque.		Crested Dogstail.
		Sudan Grass.

A careful examination of the grasses on August 17, 1918, showed that all the varieties in column one had an excellent stand and growth; those in column two had only a fair stand and growth; while all the grasses in column three had entirely killed out.

Duty of Water Plots, Ronalane, Alberta, 1918.

The grain and root crop plots were changed round this year and located a little further to the east on land that was under alfalfa in 1916. The alfalfa plots were removed from this land in 1917 because the results obtained had been unsatisfactory and the same unsatisfactory conditions existed this year as noted a little later. The alfalfa plots were on the same land as last year. The season was a very dry one with the same outstanding features as described for Strathmore. The precipitation from April to September was only 0·38 foot. The following tables contain in detail the results of the 1918 work.

Before studying the tables or the summarized comment following, it must be noted that for each series of plots, except the alfalfa, the yields on the four middle plots are not properly comparable with the two plots at each end of the series. In each series the four middle plots show yields lower than would seem to be consistent with the depths of water applied. This matter has been carefully considered and it is believed that the variation in yields is due to some lack of fertility or the lack of some chemical constituent in the strip of land on which were situated the middle plots in each series. It is also to be noted that owing to labour conditions and less constant supervision than formerly, the records from these plots may contain inaccuracies this year.

In the alfalfa plots the best yield of 3·40 tons was produced with a total depth of water (irrigation plus precipitation) of 2·98 feet. This quantity was applied under eight irrigations, which is so far from any practical programme of irrigation that the figures will not be considered. The best yield under conditions approaching field practice was 2·46 tons produced with a total depth of 1·33 feet. The dry plot produced nothing. The best wheat crop of 37·90 bushels was produced with a total depth

of 2·32 feet, and an increase in depth decreased the yield. The dry plot produced 2·55 bushels. The best oat crop of 101·5 bushels was produced with a total depth of 3·32 feet. The dry plot produced only 20·5 bushels. The best barley crop of 84·5 bushels was produced with a total depth of 2·01 feet and an increase in depth decreased the yield. The dry plot produced twenty-one bushels. The best crop of field peas of 57·25 bushels was produced with a total depth of 2·86 feet and an increase in depth decreased the yield. The dry plot produced 16·65 bushels. The best yield of potatoes, of 470·85 bushels, was produced with a total depth of 2·36 feet and an increase in depth decreased the yield. The dry plot yielded only 79·15 bushels.

Alfalfa Plots.

Plot No.	Area. Acres.	Yield in Tons per Acre. 1st Crop Cut July 9th.	2nd Crop Cut Aug. 17th.	Total.	Irrigation. Date and Depth applied in feet. May. 14.	May. 27.	June. 10.	June. 18.	June. 26.	July. 6.	July. 17.	July. 25.	August. 2.	August. 4.	Sept. 9.	Duty of Water.	Rainfall April 1 to harvest.	Total Depth Rec'd.
1	0·25	0·000	0·000	0·000												0·00	0·34	0·34
2	0·25	0·348	0·000	0·348			0·33									0·33	0·34	0·67
3	0·25	0·540	0·488	1·028		0·33					0·33					0·66	0·34	1·00
4	0·25	0·940	1·268	2·208		0·33					0·33		0·33		0·33	1·32	0·34	1·66
5	0·25	1·300	1·160	2·460	0·33			0·33			0·33				0·33	1·32	0·34	1·66
6	0·25	1·340	1·020	2·360	0·33			0·33		0·33		0·33			0·33	1·65	0·34	1·99
7	0·25	1·748	1·648	*3·396*	0·33	0·33	0·33	0·33		0·33	0·33	0·33	0·33		0·33	*2·97*	0·34	3·31
8	0·25	1·000	0·788	1·788		0·50			0·50			0·50				1·50	0·34	1·84
9	0·25	1·188	1·100	2·288		0·50			0·50		0·50			0·50	0·50	2·50	0·34	2·84
10	0·25	1·200	1·308	2·508	0·50		0·50		0·50	0·50	0·50	0·50		0·50	0·50	4·00	0·34	4·34

Wheat (Marquis) 1918.

Plot No.	Area Acres.	Yield in Bushels per Acre.	Irrigation. Date and Depth applied in feet. June 13.	June 21.	June 28.	July 2.	July 8.	July 17.	July 26.	July 31.	Aug. 5.	Duty of Water.	Rainfall April 1 to harvest.	Total Depth Rec'd.
23	0·2	2·55										0·00	0·34	0·34
24	0·2	31·25			0·33				0·33			0·33	0·34	0·67
25	0·2	34·55			0·33		0·33		0·33			0·66	0·34	1·00
26	0·2	27·90		0·33			0·33					0·99	0·34	1·33
27	0·2	25·00			0·33		0·33	0·33		0·33		1·32	0·34	1·66
28	0·2	27·50		0·33		0·33		0·33		0·33		1·32	0·34	1·66
29	0·2	31·65		0·33		0·33		0·33	0·33		0·33	1·65	0·34	1·99
30	0·2	*37·90*	0·33		0·33		0·33	0·33		0·33	0·33	*1·98*	0·34	2·32
31	0·2	36·65		0·50		0·50		0·50	0·50		0·50	2·50	0·34	2·84
23	0·2	35·85	0·50		0·50		0·50	0·50			0·50	3·00	0·34	3·34

Oats (Abundance) 1918.

Plot No.	Area. Acres.	Yield in Bushels per Acre.	Irrigation. — Date and Depth applied in feet.									Duty of Water.	Rainfall April 1 to harvest.	Total Depth Rec'd.
			June.			July.					Aug.			
			13.	21.	28.	2.	8.	17.	26.	31.	5.			
33	0·2	20·5										0·00	0·32	0·32
34	0·2	52·0			0·33							0·33	0·32	0·65
35	0·2	69·0			0·33				0·33			0·66	0·32	0·98
36	0·2	55·5		0·33			0·33		0·33			0·99	0·32	1·31
37	0·2	52·2			0·33		0·33	0·33		0·33		1·32	0·32	1·64
38	0·2	48·0		0·33		0·33		0·33		0·33		1·32	0·32	1·64
39	0·2	65·0		0·33		0·33		0·33	0·33		0·33	1·65	0·32	1·97
40	0·2	82·5	0·33		0·33		0·33	0·33	0·33		0·33	1·98	0·32	2·30
41	0·2	91·0		0·50		0·50		0·50	0·50		0·50	2·50	0·32	2·82
42	0·2	*101·5*	0·50		0·50		0·50	0·50		0·50	0·50	*3·00*	0·32	3·32

Barley (Bark's Excelsior) 1918.

Plot No.	Area. Acres.	Yield in Bushels per Acre.	Irrigation. — Date and Depth applied in feet.								Duty of Water.	Rainfall April 1 to harvest.	Total Depth Rec'd.
			June	July					August				
			28.	2.	8.	17.	26.	31.	5.	20.			
43	0·2	21·0									0·00	0·36	0·36
44	0·2	47·0				0·33					0·33	0·36	0·69
45	0·2	51·5				0·33		0·33			0·66	0·36	1·02
46	0·2	55·0		0·33			0·33		0·33		0·99	0·36	1·35
47	0·2	52·5	0·33	0·33			0·33		0·33		1·32	0·36	1·68
48	0·2	22·0		0·33	0·33			0·33	0·33		1·32	0·36	1·68
49	0·2	60·0		0·33		0·33	0·33		0·33		1·32	0·36	1·68
50	0·2	*84·5*		0·33		0·33		0·33	0·33	0·33	*1·65*	0·36	2·01
51	0·2	76·5			0·50	0·50		0·50		0·50	2·00	0·36	2·36
52	0·2	75·5		0·50		0·50		0·50	0·50	0·50	2·50	0·36	2·86

Peas (Canada Blue) 1918.

Plot No.	Area. Acres.	Yield in Bushels per Acre.	Irrigation. — Date and Depth applied in feet.									Duty of Water.	Rain-fall April 1 to harvest.	Total Depth Rec'd.
			June			July					Aug.			
			13.	21.	28.	2.	8.	17.	26.	31.	5.			
13	0·2	16·65										0·00	0·36	0·36
14	0·2	37·15			0·33							0·33	0·36	0·69
15	0·2	38·30			0·33				0·33			0·66	0·36	1·02
16	0·2	29·55		0·33			0·33		0·33			0·99	0·36	1·35
17	0·2	31·65			0·33		0·33	0·33		0·33		1·32	0·36	1·68
18	0·2	30·40		0·33		0·33		0·33		0·33		1·32	0·36	1·68
19	0·2	31·65		0·33		0·33		0·33	0·33		0·33	1·65	0·36	2·01
20	0·2	47·90	0·33		0·33		0·33	0·33		0·33	0·33	1·98	0·36	2·34
21	0·2	*57·25*		0·50		0·50		0·50	0·50		0·50	*2·50*	0·36	2·86
22	0·2	50·00	0·50		0·50		0·50	0·50		0·50	0·50	3·00	0·36	3·36

Potatoes (Gold Coin) 1918.

Plot No.	Area. Acres.	Yield in Bushels per Acre.	Irrigation. — Date and Depth applied in feet.									Duty of Water.	Rain-fall April 1 to harvest.	Total Depth Rec'd.
			June			July					Aug.			
			13.	19.	21.	2.	8.	17.	26.	31.	5.			
53	0·2	79·15										0·00	0·38	0·38
54	0·2	137·50					0·33					0·33	0·38	0·71
55	0·2	329·15					0·33		0·33			0·66	0·38	1·04
56	0·2	418·75				0·33			0·33		0·33	0·99	0·38	1·37
57	0·2	325·00				0·33		0·33	0·33		0·33	1·32	0·38	1·70
58	0·2	347·90		0·33		0·33		0·33	0·33		0·33	1·65	0·38	2·03
59	0·2	*470·85*		0·33		0·33	0·33	0·33		0·33	0·33	*1·98*	0·38	2·36
60	0·2	437·55	0·33		0·33	0·33	0·33	0·33		0·33	0·33	2·31	0·38	2·69
61	0·2	393·75		0·50		0·50		0·50		0·50	0·50	2·50	0·38	2·88
62	0·2	352·10	0·50		0·50	0·50	0·50	0·50		0·50	0·50	3·50	0·38	3·88

Summary of results at Ronalane showing the total depth of water producing the maximum yield in each year.

	1915.		1916.		1917.		1918.		Average.	
	Crop.	Depth.	Crop.	Depth.	Crop.	Depth.	Crop.	Depth.	Crop.	Depth.
Alfalfa	4·04	1·94	3·82	3·27	3·13	1·68	2·46	1·33	3·36	2·05
Wheat	48	1·55	48	1·82	50	1·86	38	2·32	46	1·89
Oats	108	3·00	79	1·82	106	1·36	101	3·32	95	2·17
Barley	48	1·41	56	1·77	55	1·35	84	2·01	61	1·63
Peas	25	1·78	53	2·90	61	1·35	57	2·86	49	2·22
Sugar Beets	10	1·55	11	2·24	17	1·16	.....	.....	14	1·65
Potatoes	408	2·03	294	1·82	.....	.....	471	2·36	391	2·07

Duty of Water, Coaldale, Alberta, 1918.

The work at Coaldale was carried on during 1918 in the same manner as previously. Lethbridge records show that this was the driest year recorded since 1902, with the exception of 1910 which had 0·38 inch less rainfall during the growing season. The precipitation at Coaldale from April to September was only 0·37 foot.

The season opened extremely early, ploughing being well under way during the month of March, and seeding was in full swing by April 10. By the end of April fully ninety-five per cent of the wheat had been seeded. During the months of April, May and June, the rainy season for the Coaldale district, only 1·83 inches of moisture were received. The whole summer abounded in hot, sultry days, or was marked by warm, dry, southwest winds which soon drew all moisture from the soil and shrivelled the crops. These drying winds caused much damage even on the irrigated farms, and particularly with crops of grain. In the case of alfalfa under irrigation very large yields were obtained, the warm dry weather prevalent during July and August causing a most rapid and luxuriant growth.

The table following gives a summary of all the data in regard to the work carried out. From this it will be noted that all alfalfa fields received two irrigations and in some cases three were made. It is worthy of note that each field was irrigated before the first cutting was made, which is not the practice generally followed in this district but was necessary owing to the very dry spring. In all cases a very good first cutting was obtained. Plot No. 305 (alfalfa and timothy) yielded the best, producing 2·37 tons per acre in the first cutting. The second cutting was not as satisfactory in all cases as it might have been. This was due in a few cases to a shortage of water during July, and to the impossibility of getting experienced irrigators. For the second cutting, Plot No. 310 yielded 2·43 tons per acre. One or two farmers made three cuttings with very evident success. The total yield for the season was very high. Plot No. 305 with a yield of 4·94 tons per acre was the highest.

Crop.	Plot. No.	Acres.	Yield.		No.	Irrigation.				Acre-Feet per Acre.							
			Per Cutting.	Per Acre. Tons.		Began.	Ended.	Duration in Hours.	Average Head c.f.s.	Supplied.	Wasted.	Used.	Used per Acre.	Duty.	Rainfall.	Total Water Rec'ved	Total Water Used.
Alfalfa	302	30·00	1·73		1	May 30	June 10	163	2·85	38·40	9·27	29·13	0·97				
			0·73		2	July 11	July 22	214	2·20	38·92	6·35	32·57	1·08	2·05	0·31	2·36	1·74
			0·27	2·73													
Alfalfa	304	42·00	1·35		1	May 26	June 14	437	1·45	52·40	7·58	44·82	1·07				
			0·68	2·03	2	Aug. 16	Sept. 2	412	1·25	42·43	13·74	28·69	0·68	1·75	0·30	2·05	1·56
Alfalfa	306	14·00	1·82		1	May 27	May 30	73	1·57	9·45	2·68	6·77	0·48				
			1·44	3·26	2	July 9	July 14	105½	1·91	16·64	6·34	10·30	0·74				
					3	Sept. 27	Oct. 1	101	1·61	13·44	4·02	9·42	0·67	1·89	0·27	2·16	1·77
Alfalfa	310	19·70	1·56		1	May 13	May 17	103	1·89	16·06	1·88	14·18	0·72				
			2·43	3·99	2	July 9	July 16	172	0·88	12·44	0·00	12·44	0·63	1·35	0·30	1·65	1·90
Alfalfa	312	50·00	1·14		1	May 7	May 13	138	2·98	33·96	7·28	26·63	0·53				
			0·96	2·10	2	July 16	July 25	216	3·57	63·68	29·35	34·33	0·69	1·22	0·33	1·55	0·92
Alfalfa	313	50·00	1·61		1	June 6	June 15	157	4·49	58·24	0·00	58·24	1·16				
			1·85	3·46	2	Aug. 4	Aug. 12	190	3·78	59·42	3·55	55·87	1·12	2·28	0·33	2·61	2·38
Alfalfa	314	35·09	1·94		1	June 9	June 29	145	2·10	25·12	0·00	25·12	0·71				
			2·38	4·32	2	July 25	Aug. 20	244	2·79	56·32	0·00	56·32	1·60	2·31	0·33	2·64	2·29
Alfalfa	315	50·00	1·63		1	May 15	June 8	395	2·50	81·58	0·00	81·58	1·63				
			1·99		2	July 9	July 21	294	2·43	59·02	0·00	59·02	1·18	2·81	0·34	3·15	3·09
			0·75	4·37													
Alfalfa	324	32·73	2·13		1	May 26	June 21	238	1·68	33·06	0·51	32·55	0·99				
			1·18	3·31	2	Aug. 16	Sept. 4	446	1·19	43·99	9·06	34·93	1·07	2·06	0·30	2·36	2·10
Alfalfa and Timothy.	305	23·50	2·37		1	May 30	June 5	144	3·27	39·00	21·51	17·49	0·74				
			1·85		2	July 13	July 20	158	2·95	38·49	20·28	18·21	0·77				
			0·72	4·94	3	Sept. 14	Oct. 7	364	1·05	31·60	12·56	19·04	0·81	2·32	0·30	2·62	2·87
Timothy	307	65·60	0·30	0·30	1	May 27	June 3	174	5·54	79·65	11·04	68·61	1·04	1·04	0·27	1·31	1·49
Timothy	303	22·50			1	May 15	May 24	203	1·85	31·06	5·98	25·08	1·11				
			0·38	0·38	2	June 27	July 2	101	1·80	14·98	4·89	10·09	0·45	1·56	0·33	1·89	2·08
Buckwheat	308	72·00	38·00	38·00	1	June 18	June 29	278	2·62	60·13	4·02	56·11	0·78	0·78	0·28	1·06	1·06
Buckwheat	323	8·65		25·8	1	June 16	June 21	102	0·92	7·80	0·12	7·68	0·89	0·89	0·30	1·19	0·79
Buckwheat	316	85·60			1	May 13	May 25	258	3·15	67·26	3·25	64·01	0·75				
				19·9	2	June 26	July 18	540	2·52	112·62	22·34	90·28	1·05	1·80	0·30	2·10	2·12
Oats	322	13·30		17·3	1	June 23	June 27	100	1·67	13·78	0·00	13·78	1·04	1·04	0·28	1·32	1·03
						Average for 16 irrigated tracts...								1·70	0·30	2·00	1·82

The timothy fields under observation gave very light yields. This was due to several causes, particularly lack of moisture, for with the very warm season water could have been kept running on the fields almost continuously. The fact that the timothy fields appeared to be sod-bound helped materially to decrease the yield.

The grain yields are not very high due to lack of moisture and the dry winds which were prevalent all summer. Even where the water was available it was not always applied at the most opportune time. One field (No. 316) was sown on fall ploughed timothy sod which was very dry and had to be irrigated before the seed would germinate.

In this year's results, where reasonably light irrigations were applied at opportune periods, much better results were obtained than where excessive depths were applied, possibly either too late or with too great an interval between applications. It is very noticeable from the table, what very excessive depths in many cases were applied to the fields at one irrigation.

Careful data were gathered, showing the quantity of available water held in the soil at the beginning and at the end of the season. These data are not being tabulated in detail in this report, but the results are shown in the column "Total Water Used" in the table above. For all the alfalfa plots the total depth received was 0·25 foot greater than the depth of water actually used by the crop; for the timothy plots the total depth used by the crop was 0·19 foot greater than the total depth received, and for the grains the total depth received was 0·17 foot greater than the total depth used by the crop. In other words, the alfalfa and grains had more water applied to them than they could use, while the timothy did not have enough and drew on the water stored in the soil in the spring.

Table Showing Total Depth of Water Used on Coaldale, Alta., Tracts, 1913 to 1918 Inclusive.

Crop.	1913.			1914.			1915.			1916.			1917.			1918.			Average 1913-18 incl've.		
	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.	Duty.	Precipitation.	Total Water Rec'd.
Alfalfa	1·70	0·98	2·68	2·11	0·57	2·68	0·68	1·32	2·00	0·41	1·56	1·97	1·31	0·68	1·99	2·00	0·31	2·31	1·37	0·90	2·27
Timothy	0·85	0·98	1·83	.....	.....	.....	1·28	1·32	2·60	0·33	1·56	1·89	1·48	0·71	2·19	1·30	0·30	1·60	1·05	0·97	2·02
Wheat	0·74	0·98	1·72	.....	.....	.....	0·22	1·32	1·54	0·00	1·73	1·73	0·78	0·41	1·19	1·16	0·29	1·45	0·58	0·95	1·53
Oats	.....	.....	.....	1·49	0·57	2·06	0·00	1·32	1·32	0·00	1·73	1·73	.....	.....	.....	1·04	0·28	1·32	0·63	0·98	1·61
Barley	.....	.....	.....	1·25	0·57	1·82	0·00	1·32	1·32	0·00	1·56	1·56	.....	.....	.....	.....	.....	.....	0·42	1·15	1·57
Summer Fallow	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0·90	0·72	1·62	.....	.....	.....	0·90	0·72	1·62
Average	1·15	0·98	2·13	1·84	0·57	2·41	0·57	1·32	1·89	0·28	1·56	1·84	1·18	0·65	1·83	1·70	0·30	2·00	1·12	0·90	2·02

1913—No oat or barley tracts available. 1914—No timothy grown on tracts. Wheat tracts were dried up and destroyed by cutworms. 1917—No barley grown on tracts. Oat tracts were at extreme end of canal system which at the critical time did not contain sufficient water to permit of them being irrigated. 1918—No barley tracts available.

The above table shows the average total depths of water received (irrigation plus precipitation) for the Coaldale plots for 1913 to 1918. The average total depth of water received by the grain plots for six years is 1·62 feet. The average duty of water for the same six years is 0·71 foot. For the alfalfa and grasses the average total depth received for six years is 2·23 feet and the average duty of water is 1·21 feet. For all the plots, alfalfa, grasses and grains, the average total depth received for six years is 2·04 feet. The average duty of water for six years is 1·13 feet.

Brooks Experimental Station, 1918.

The land for the Brooks Experimental Station was broken to an average depth of two and one-half inches, during June, 1917, and then worked down with disc and drag harrow. It was harrowed occasionally throughout the summer and in September was backset to an average depth of seven inches, worked down with harrows, floated, and levelled with the fresno scraper. In the spring of 1918, as soon as the land was dry enough to work, it was again disced, floated and then seeded. The season was a very dry one.

April and May were very dry months, no precipitation occurring in April, and but 0·42 inch in May 0·33 inch of which fell in the form of snow and sleet on the 16th of the month. Frost occurred on twenty-three days in April and on sixteen days in May. From the 16th to the 27th of May inclusive, excepting only the 18th and 24th, frost occurred every night. May 9th had 17° of frost and May 27th had 7° of frost. These cold nights and especially the heavy frosts mentioned on the 9th and 27th of May, did much to retard the growth of grains, and grain crops on June first showed only two to six inches growth, having been bitten down by the last heavy frost. The season as a whole was very warm, having a mean temperature (Apr.-Sept.) of 58° as compared with 56·3° for 1917. The total precipitation, April to September, was but 3·81 inches, most of which occurred during July and August. There was only one rain during the season in which more than one-half inch of precipitation occurred; this fell on July 27th and amounted to 0·66 inch. The others were so small that, falling on the very dry, baked soil, they did not penetrate far enough to establish a capillary connection with the underlying soil moisture and hence were of little if any value to the crops. In the diagrams and tables, the total precipitation occurring between April and September, is noted as being received by the crops. While this is true it is apt to be misleading, for, on account of the above mentioned conditions, viz.: light rains, hot dry soil, heavy winds, etc., it is doubtful if more than about one inch of rainfall actually penetrated far enough into the soil to be available to the crops. The following tables contain in detail the results of the 1918 work.

In studying the tables it is to be noted that column *total depth received* is the sum of *duty of water* and *rainfall*. The column *total depth used in growing the crop* shows the depth of water actually used up by the crop as computed by soil moisture determinations.

The best wheat crop in series A was 40·7 bushels produced with a total depth of 1·76 feet; in series B. 49·4 bushels produced with a total depth of 2·26 feet. It would seem reasonable to adopt the mean of these figures giving 45 bushels produced by 2·01 feet. The dry plot produced 1 bushel, a practical crop failure.

The best oat crops in both series of 113 bushels and 95 bushels respectively were produced with a total depth of 1·90 feet. The dry crop produced 10 bushels.

The best barley crop in series A. was 78·8 bushels produced with a total depth of 2·00 feet; in series B. 68·5 bushels produced with a total depth of 1·70 feet. The mean of these figures would give 73·6 bushels produced by 1·85 feet. The two dry plots produced respectively 0·8 bushel and 5·6 bushels.

The best pea crop in series A. was 50·8 bushels produced with a total depth of 1·93 feet; in series B. 45·5 bushels produced with a total depth of 2·26 feet. The mean of these figures would give 48·1 bushels produced by 2·09 feet. The two dry plots produced respectively 6·2 and 8·7 bushels.

The best crop of flax, series A. only, was 30·1 bushels produced with a total depth of 2·23 feet. It should be noted in this case that the total depth actually used in growing the crop was only 1·33 feet. The dry plot produced only 5·7 bushels.

The best potato crop in both series of 346·2 bushels and 277·3 bushels respectively were produced with a total depth of 2·29 feet. The dry crops produced respectively 44 bushels and 81·2 bushels.

It is noticeable in studying these data that the series A. crops did not produce as well as the series B. crops on the dry plots. On the contrary the series A. crops produced better than the series B. under irrigation. Possibly there is some difference in soil conditions that accounts for this. The series A. plots are grouped together at the east end of the station, while the series B. plots are located in the central and westerly parts of the station.

Wheat 1918.

Series A

Plot No.	Area in acres.	Yield in Bushels per Acre.	Irrigation Date and Depth applied in feet. June. 3	June. 20	June. 27	July. 9	July. 18	July. 24	July. 29	Aug. 3	Duty of Water.	Rainfall April 1st to Harvest.	Total Depth received	Total Depth used in growing the Crop.
15	0·25	1·0	.....	.....	.....	.....	.....	.....	.....	.....	0·00	0·20	0·20	0·44
14	0·25	13·8	.....	0·33	.....	.....	.....	.....	.....	.....	0·33	0·20	0·53	0·67
13	0·25	21·1	.....	0·33	.....	.....	0·34	.....	.....	.....	0·67	0·26	0·93	0·94
20	0·25	34·8	.....	0·33	.....	0·33	.....	0·34	.....	.....	1·00	0·26	1·26	1·17
19	0·25	23·5[1]	0·33	.....	0·33	.....	0·34	.....	0·33	.....	1·33	0·26	1·59	1·37
18	0·25	35·6	0·33	.....	0·33	0·34	.....	0·33	.....	0·34	1·67	0·26	1·93	1·74
17	0·25	39·3	0·33	.....	0·33	0·34	0·33	.....	0·33	0·34	2·00	0·26	2·26	1·75
16	0·25	30·1	.....	0·50	.....	.....	0·50	.....	.....	.....	1·00	0·26	1·26	1·54
12	0·25	*40·7*	.....	0·50	.....	0·50	.....	0·50	.....	.....	*1·50*	0·26	1·76	1·69
11	0·25	27·3	0·50	.....	0·50	.....	0·50	.....	0·50	.....	2·00	0·26	2·26	1·48

Series B

			June. 1	June. 3	June. 7	June. 18	June. 25	July. 6	July. 9	July. 16	July. 22	July. 28	Aug. 2				
78	0·174	31·2	.....	.....	.....	0·33	.....	.....	.....	0·34	.....	.....	.....	0·67	0·24	0·91	0·92
79	0·20	38·9	.....	.....	.....	0·33	.....	0·33	.....	.....	0·34	.....	.....	1·00	0·26	1·26	1·44
46	0·20	30·7[1]	0·33	.....	.....	.....	0·33	.....	.....	0·34	.....	0·33	.....	1·33	0·26	1·59	1·29
47	0·20	36·0[1]	0·33	.....	.....	.....	0·33	.....	0·34	.....	0·33	.....	0·34	1·67	0·26	1·93	1·43
64	0·20	*49·4*	.....	0·33	.....	.....	0·33	0·34	.....	0·33	.....	0·33	0·34	*2·00*	0·26	2·26	2·13
65	0·20	33·7	.....	.....	.....	0·50	0·50	.....	.....	.....	.....	.....	.....	1·00	0·24	1·24	1·36
89	0·20	38·5	.....	.....	.....	0·50	.....	0·50	.....	.....	0·50	.....	.....	1·50	0·26	1·76	1·78
90	0·20	30·4	.....	.....	0·50	.....	0·50	.....	.....	0·50	0·50	.....	.....	2·00	0·26	2·26	1·82

[1] Plot very patchy due to burnouts.

Series A.

Plot No.	Area in Acres.	Yield in bush. per Acre.	Irrigation Date and Depth applied in feet. June. 4	June. 21	June. 26	July. 10	July. 18	July. 24	July. 30	Aug. 3	Duty of Water.	Rainfall April 1st to Harvest.	Total Depth received	Total Depth used in growing the Crop.
26	0·25	10·1	.....	.....	.....	.....	.....	.....	.....	.....	0·00	0·20	0·20	0·45
27	0·25	38·0	.....	0·33	.....	.....	.....	.....	.....	.....	0·33	0·20	0·53	0·83
28	0·25	47·1	.....	0·33	.....	.....	0·34	.....	.....	.....	0·67	0·29	0·96	1·22
21	0·25	83·3	.....	0·33	.....	0·33	.....	0·34	.....	.....	1·00	0·26	1·26	.....
22	0·25	100·1	0·33	.....	0·33	.....	0·34	.....	0·33	.....	1·33	0·26	1·59	1·58
23	0·25	*113·0*	0·33	.....	0·33	0·34	.....	0·33	.....	0·34	*1·67*	0·26	1·93	1·82
24	0·25	108·7	0·33	.....	0·33	0·34	0·33	.....	0·33	0·34	2·00	0·26	2·26	2·31
25	0·25	66·1	.....	0·50	.....	.....	0·50	.....	.....	.....	1·00	0·29	1·29	1·40
29	0·25	66·8	.....	0·50	.....	0·50	.....	0·50	.....	.....	1·50	0·29	1·79	1·83
30	0·25	53·9	0·50	.....	0·50	.....	0·50	.....	0·50	.....	2·00	0·26	2·26	2·45

Series B.

			June. 8	June. 18	June. 25	July. 5	July. 15	July. 22	July. 27	July. 29	Aug. 3				
62	0·20	58·7	.....	0·33	.....	.....	0·34	.....	.....	.....	.....	0·67	0·20	0·87	1·17
63	0·20	81·1	.....	0·33	.....	0·33	.....	0·34	.....	.....	.....	1·00	0·20	1·20	1·34
94	0·20	73·1[1]	0·33	.....	0·33	.....	0·34	.....	0·33	.....	.....	1·33	0·23	1·56	.....
77	0·157	95·0	0·33	.....	0·33	0·34	.....	0·33	.....	.....	0·34	*1·67*	0·23	1·90	1·45
87	0·20	94·1	0·33	.....	0·33	0·34	0·33	.....	.....	0·33	0·34	2·00	0·26	2·26	1·81
88	0·20	57·4	.....	0·50	.....	.....	0·50	.....	.....	.....	.....	1·00	0·29	1·29	1·21
93	0·20	68·7	.....	0·50	.....	0·50	.....	0·50	.....	.....	.....	1·50	0·26	1·76	1·83
76	0·20	94·1	0·50	.....	0·50	.....	0·50	.....	0·50	.....	.....	2·00	0·23	2·23	1·93

[1]Poor stand secured on plot after seeding.

Barley, 1918.

Series A.

Plot No.	Area in Acres.	Yield in Bushels per Acre.	Irrigation Date and Depth applied in feet. June. 5	June. 11	June. 22	June. 28	July. 9	July. 18	July. 23	July. 28	Aug. 3	Duty of Water.	Rainfall April 1st to Harvest.	Total Depth received	Total Depth used in growing the Crop.
32	0·85	00·8										0·00	0·20	0·20	0·59
33	0·065	20·7			0·33							0·33	0·20	0·53	0·71
31	0·078	23·4			0·33			0·34				0·67	0·20	0·87	1·05
38	0·25	45·4			0·33		0·33		0·34			1·00	0·20	1·20	1·45
39	0·25	56·6	0·33			0·33		0·34		0·33		1·33	0·20	1·53	1·32
40	0·25	67·2	0·33			0·33	0·34		0·33		0·34	1·67	0·20	1·87	1·26
37	0·25	72·1		0·33		0·33	0·34	0·33		0·33	0·34	*2·00*	0·20	2·20	1·99
36	0·25	49·1			0·50			0·50				1·00	0·20	1·20	1·16
34	0·075	63·5			0·50		0·50			0·50		1·50	0·20	1·70	1·50
35	0·077	*78·8*	0·50			0·50	0·50		0·50			*2·00*	0·20	2·20	1·82

Series B.

			June. 12	June. 18	June. 26	July. 8	July. 16	July. 22	July. 28	Aug. 3				
60a	0·046	5·6									0·00	0·20	0·20	0·60
60b	0·056	25·3		0·33							0·33	0·20	0·53	0·84
60c	0·036	28·0		0·33			0·34				0·67	0·20	0·87	1·14
60d	0·036	35·4		0·33		0·33		0·34			1·00	0·20	1·20	1·51
60e	0·036	64·3	0·33		0·33	0·34			0·33		1·33	0·20	1·53	
61a	0·042	*66·4*	0·33		0·33	0·34		0·33		0·34	*1·67*	0·20	1·87	2·19
61b	0·036	64·4	0·33		0·33	0·34	0·33		0·33	0·34	2·00	0·20	2·20	2·28
61d	0·036	*68·5*		0·50		0·50		0·50			*1·50*	0·20	1·70	1·79
61e	0·036	57·2	0·50		0·50		0·50		0·50		2·00	0·20	2·20	2·12

Series C.

			June.		July.				Aug.				
			11	25	5	15	22	28	3				
85a	0·036	2·9	.....	.....	.....	.....	.....	.....	.....	0·00	0·20	0·20	0·42
85b	0·036	8·9	.....	0·33	.....	.....	.....	.....	.....	0·33	0·20	0·53	0·60
85c	0·036	19·0	.....	0·33	.....	0·34	.....	.....	.....	0·67	0·20	0·87	.....
85d	0·036	32·1	.....	0·33	0·33	.....	0·34	.....	.....	1·00	0·20	1·20	0·96
85e	0·036	23·7	0·33	0·33	.....	0·34	.....	0·33	.....	1·33	0·20	1·53	0·87
86a	0·036	55·3	0·33	0·33	0·34	.....	0·33	.....	0·34	1·67	0·20	1·87	1·73
86b	0·036	*65·5*	0·33	0·33	0·34	0·33	.....	0·33	0·34	*2·00*	0·20	2·20	1·48
86c	0·036	32·1	.....	0·50	.....	0·50	.....	.....	.....	1·00	0·20	1·20	1·06
86d	0·036	42·3	.....	0·50	0·50	.....	0·50	.....	.....	1·50	0·20	1·70	1·68
86e	0·036	48·7	0·50	0·50	.....	0·50	.....	0·50	.....	2·00	0·20	2·20	1·98

Peas (Prussian Blue), 1918.

SERIES A.

Plot No.	Area in Acres.	Yield in Bushels per Acre.	Irrigation–date and depth applied in ft.								Duty of Water.	Rainfall April 1 to Harvest.	Total Depth Received	Total Depth used in growing the Crop.
			June.			July.				Aug.				
			3	20	27	8	18	24	30	3				
6	0·25	6·2									0·00	0·20	0·20	0·70
7	0·25	16·9		0·33							0·33	0·20	0·53	0·69
8	0·25	29·5		0·33			0·34				0·67	0·26	0·93	0·93
1	0·25	38·0		0·33		0·33		0·34			1·00	0·23	1·23	1·23
2	0·25	33·9[2]	0·33		0·33		0·34		0·33		1·33	0·23	1·56	1·47
3	0·25	*50·8*	0·33		0·33	0·34		0·33		0·34	*1·67*	0·26	1·93	1·97
4	0·20	44·5	0·33	0·33		0·34	0·33		0·33	0·34	2·00	0·26	2·26	2·12
5	0·25	33·2		0·50			0·50				1·00	0·23	1·23	1·10
9	0·25	32·4[2]		0·50		0·50		0·50			1·50	0·26	1·76	1·65
10	0·25	37·0	0·50		0·50		0·50		0·50		2·00	0·26	2·26	1·84

SERIES B.

			June.			July.					Aug.				
			8	18	25	6	15	22	27	30	3				
82	0·179	8·7										0·00	0·20	0·20	
80	0·058	28·7		0·33			0·34					0·67	0·20	0·87	
69*a*	0·094	36·2		0·33		0·33		0·34				1·00	0·26	1·26	
50	0·20	37·7	0·33		0·33		0·34			0·33		1·33	0·26	1·59	
51	0·20	14·0[1]	0·33		0·33	0·34		0·33			0·34	1·67	0·20	1·87	2·30
68*a*	0·083	45·5	0·33		0·33	0·34	0·33		0·33		0·34	*2·00*	0·26	2·26	
69*b*	0·10	33·2		0·50				0·50				1·00	0·26	1·26	
68*b*	0·087	38·2		0·50			0·50		0·50			1·50	0·26	1·76	
81	0·334	25·3[2]	0·50		0·50	0·50	0·50					2·00	0·20	2·20	1·95

[1]Very poor stand secured after seeding. [2]Shattered by a heavy wind storm.

Flax, 1918.

SERIES A.

Plot No.	Yield in Bushels per Acre.	Irrigation—Date and Depth applied in feet.								Duty of Water.	Rainfall April 1 to Harvest.	Total Depth Received	Total Depth used in growing the Crop.
		June.				July.			Aug.				
		11	15	22	26	8	18	24	29	7				
44*c*	5·7										0·00	0·20	0·20	0·48
44*d*	10·8			0·33							0·33	0·20	0·53	
44*b*	11·4			0·33			0·34				0·67	0·20	0·87	0·66
44*a*	22·2		0·33			0·33	0·34				1·00	0·20	1·20	0·77
44*e*	23·3	0·33			0·33		0·34		0·33		1·33	0·23	1·56	1·28
45*a*	26·7	0·33	0·34		0·33	0·34		0·33	0·34		1·67	0·23	1·90	1·22
45*b*	*30·1*	0·33	0·34		0·33	0·34	0·33		0·33	0·34	*2·00*	0·23	2·23	1·33
45*c*	10·2			0·50			0·50				1·00	0·23	1·23	1·30
45*d*	15·9		0·50	0·50		0·50		0·50			1·50	0·23	1·73	1·81
45*e*	23·3	0·50			0·50		0·50		0·50		2·00	0·23	2·23	1·65

Potatoes, 1918.

SERIES A.

Plot	Area in Acres.	Yield in Bushels per Acre.	Percentage No.1 Grade Potatoes.	Irrigation—Date and Depth applied in feet. June. 12	June. 24	June. 27	July. 12	July. 18	July. 24	July. 30	August. 2	August. 7	Duty of Water.	Rainfall April 1 to Harvest.	Total Depth Received.
48*d*....	0·044	44·0	0	....	....	....	....	....	....	....	....	....	0·00	0·29	0·29
48*b*....	0·044	76·1	1	....	0·33	....	....	....	....	....	....	....	0·33	0·29	0·62
48*c*....	0·044	103·8	7	....	0·33	....	....	0·34	....	....	....	....	0·67	0·29	0·96
48*a*....	0·044	163·6	5	....	0·33	....	0·33	....	0·34	....	....	....	1·00	0·29	1·29
48*e*....	0·022	177·3	11	0·33	....	0·33	....	0·34	....	0·33	....	....	1·33	0·29	1·62
49*a*....	0·033	231·3	19	0·33	....	0·33	0·34	....	0·33	....	0·34	....	1·67	0·29	1·96
49*b*....	0·044	*346·2*	24	0·33	....	0·33	0·34	0·33	....	0·33	....	0·34	*2·00*	0·29	2·29
49*c*....	0·044	166·6	10	....	0·50	....	....	0·50	....	....	....	....	1·00	0·29	1·29
49*d*....	0·044	195·9	14	....	0·50	....	0·50	....	0·50	....	....	....	1·50	0·29	1·79
49*e*....	0·044	199·6	11	0·50	0·50	....	....	0·50	....	0·50	....	....	2·00	0·29	2·29

SERIES B.

				June. 19	June. 24	June. 26	July. 11	July. 20	July. 25	July. 30	August. 5	August. 14			
9192*a*.....		81·2	0	....	....	....	....	....	....	....	....	....	0·00	0·29	0·29
9192*b*.....		137·9	5	....	0·33	....	....	....	....	....	....	....	0·33	0·29	0·62
9192*c*.....		164·4	9	....	0·33	....	....	0·34	....	....	....	....	0·67	0·29	0·96
9192*d*.....		173·4	10	....	0·33	....	0·33	....	0·34	....	....	....	1·00	0·29	1·29
9192*e*.....		165·4	15	0·33	....	0·33	....	0·34	....	0·33	....	....	1·33	0·29	1·62
9192*f*.....		263·1	25	0·33	....	0·33	0·34	....	0·33	....	0·34	....	1·67	0·29	1·96
9192*g*.....		277·3	18	0·33	....	0·33	0·34	0·33	....	0·33	....	0·34	2·00	0·29	2·29
9192*h*.....		118·1	7	....	....	0·50	....	0·50	....	....	....	....	1·00	0·29	1·29
9192*k*.....		140·9	11	....	....	0·50	0·50	....	0·50	....	....	....	1·50	0·29	1·79
9192*l*.....		147·2	9	0·50	....	0·50	....	0·50	....	0·50	....	....	2·00	0·29	2·29

DISCUSSION OF SUMMARIZED DATA.

The natural precipitation varies greatly from year to year and directly affects the duty of water. In dry years a greater depth of irrigation is required than in wet years. The clearest way to view the matter is to consider both natural precipitation and irrigation water simply as so much depth of water applied to the crops. Then by adding together natural precipitation and irrigation water we get the total depth of water applied and thus have a figure which is readily comparable from year to year. This latter statement must not be accepted absolutely, because the seasonal distribution of the precipitation and temperature also has a marked effect on the crop growth. It must always be kept in mind that soil and subsoil conditions have a very marked effect on the duty of water, so that in compairing results gained at different places many conditions must be considered to get a true perspective.

The first table below is inserted to show the climatic conditions for the five years, 1914, 1915, 1916, 1917 and 1918 at the four stations from which data have been taken in writing the general discussion on duty of water for the several crops which follows, The second table is inserted for purposes of comparison showing the average climatic conditions which prevailed during the five years as compared with long term averages. In both cases the period April to September, both inclusive is used.

	Precipitation. 1914.	1915.	1916.	1917.	1918.	Temperature. 1914.	1915.	1916.	1917.	1918.
	Feet.	Feet.	Feet.	Feet.	Feet.	°F	°F	°F	°F	°F
Strathmore	0·71	1·44	1·33	0·85	0·48	52·4	52·6	50·6	52·0	52·8
Ronalane	0·38	0·93	1·32	0·50	0·38	59·4	57·1	55·2	55·8	56·8
Coaldale	0·57	1·32	1·56	0·72	0·37	55·9	55·4	54·5	55·4	55·9
Brooks	.....	.....	.....	0·57	0·32	55·6	56·3	.....	56·3	58·0

	Precipitation.		Temperature.	
	1914–1918.	Long Term.	1914–1918.	Long Term.
	Feet.	Feet.	°F	°F
Calgary	0·80	1·04	54·35	52·42
Medicine Hat	0·77	0·77	59·79	58·77
Lethbridge	0·90	0·95	54·79	55·69

Calgary—index for Strathmore—long term records 1885–1918; Medicine Hat index for Ronalane and Brooks—long term records 1884–1918; Lethbridge—index for Coaldale—long term records 1903–1918.

The following chart is included to indicate the different soil conditions at Strathmore, Ronalane, Coaldale and Brooks.

Diagram showing typical soils of

	Strathmore.	Ronalane.	Coaldale.	Brooks.
First Foot.	Sandy Soil.	fine sandy loam soil	Clay Loam.	Fine Sandy Loam.
Second Foot.	Fine Sandy Soil to depth varying from 3 to 7 feet.	Sandy Loam.	Light Clay Loam	Very uniform. Soil. Very fine sand and silt.
Third Foot.			very uniform	
Fourth Foot.			has no impervious stratum.	Light gravel at 12 to 14 feet depth.
Fifth Foot.	Heavy Clay and gumbo subsoil	Sand and Gravel.		
Sixth Foot.	Very impervious.			

In previous reports attention has been drawn to the difficulty of drawing definite conclusions from the data available. In work of this nature where results vary from year to year, it is necessary to have results tabulated consecutively over a considerable period of years before definite conclusions can be drawn. Instead of waiting until the end of the period before publishing results, it has been thought better to publish the data annually and also such conclusions as could be drawn from them. Previously it has been the practice to summarize the results gained in a short statement regarding each crop. As the period of years to which reference has to be made lengthens, this method becomes more and more difficult and is apt to be confusing. In this report the data have all been summarized in the table below which it is thought shows correctly the average of all results gained to date. The column *crop* is inserted as a useful index to the results gained at the different places. The column *depth* shows the total of water received in feet (irrigation plus precipitation). The *average depth* shown is the average of the depths at the different places according to the number of years' records. The column marked 1-4 shows the average for the four places, and the column marked 2-4 shows the average for Coaldale, Ronalane and Brooks only. The results at Strathmore are based on plot work carried on for five years, but owing to several causes the crop data covers only from one to four years' records. The data at Coaldale is based on results gained by average farmers irrigating their own fields over a period of six years. The crops at Coaldale have been omitted because they would not be comparable with the crops grown on the small plots. The results at Ronalane are based on plot work carried on consistently for four years and constitute the most reliable data available at the present time. The results at Brooks are based

on plot work, but cover the year 1918 only. For Strathmore, Ronalane and Brooks the figurese shown are the average at each place of the total depths of water producing the best crop in each year; for Coaldale the figures represent the average of ordinary crops in each year.

——	1 Strathmore.		2 Coaldale.		3 Ronalane.		4 Brooks.		1-4	2-4
	Crop.	Depth.	Crop.	Depth.	Crop.	Depth.	Crop.		Average Depth.	Average Depth.
	Bushels.		Bushels.		Bushels.		Bushels.			
Wheat	45	1·36	.....	1·53	46	1·89	45	2·01	1·62	1·72
Oats	133	1·30	.....	1·61	95	2·17	104	1·90	1·69	1·86
Barley	36	1·17	.....	1·57	61	1·63	74	1·85	1·54	1·63
Peas	28	1·06	.....	.....	49	2·22	48	2·09	1·87	2·19
Potatoes	447	1·22	.....	.....	391	2·07	312	2·29	1·82	2·12
	Tons.				Tons.		Tons.			
Alfalfa	4·26	1·40	.....	2·27	3·36	2·05	.....	.....	2·05	2·18
Grasses	2·00	1·23	.....	2·02	.....	.....	.....	.....	1·67	2·02
Sugar Beets	.....	.....	.....	.....	14	1·65	.....	.....	1·65	1·65

In our opinion column 2-4 indicates quite closely the total depths required for the various crops in the part of Alberta south of township twenty-eight, and exclusive of the strip influenced by proximity to the foothills and latitude, which might be generally described as the territory lying west of range twenty-three. The Strathmore column, while being less reliable, indicates the smaller quantities of water required in the territory lying west of range twenty-three. If this opinion is correct the figures in column 2-4 will be representative for the great bulk of all the irrigable land in Alberta.

If we assume that ultimately all irrigated farms will be one-half sown down to alfalfa and one-half cropped to one of the common grains, we are assuming a condition that represents a high water requirement and a sound system of crop rotation. The average depth from column 2-4 for wheat, oats and barley is 1·70 feet. For alfalfa the depth is 2·18 feet. Under the condition assumed then, the total depth required for the whole area would be the mean of these two figures or 1·94 feet. Under this condition with the legal duty of 1·50 feet we must rely upon a precipitation of 0·44 foot (about 5¼ inches) to meet the crop requirements.

The season of 1918 is probably as dry a season as has ever been experienced in Alberta, and the average precipitation from April to September for Coaldale, Ronalane and Brooks was 0·36 foot or 4¼ inches. The average long term precipitation for this season at Medicine Hat and Lethbridge is 0·86 foot or 10¼ inches.

Cypress Hills District.

This whole district has, for purposes of administration, been divided into four sub-districts, the north, south, east and west. No crop report was submitted by Mr. Tempest covering the north and west districts. Mr. M. H. French has submitted a report on the south and east districts which is submitted almost in its entirety because it gives a good idea of the conditions which existed in the whole district during the past season:—

> "The season opened up early and nearly all of the snow was gone by the last of March. Most of the farmers got things in readiness to commence seeding immediately, but the weather tightened up a little the first part of April and delayed seeding a couple of weeks. All wheat was practically in by May 1st, but the seeding of oats, barley and flax continued until the first part of June in the patriotic effort of the farmers to get in as large an acreage as possible. Some farmers even took a chance on breaking up considerable areas of virgin prairie and seeding it to flax with the expectation of a wet season and a late fall frost.

"Because of a good initial supply of moisture in the surface soil, the seed germinated well. The continued cool weather through the early summer caused the plants to stool out well and develop a deep root system which enabled them to withstand, to a more or less degree, the severe drought during July and August. Owing to the continued dry weather the straw grew very little and the grain headed out early. The heads were of a fair size and would have given a fair yield of grain had there been sufficient moisture available to enable them to fill properly. As it was, a few kernels received all the nourishment of the plant and the rest withered up. This resulted in an excellent sample of wheat, but low in yield. The high quality of the grain this last suummer was noticeable everywhere, and with the high prices, helped materially to pay farm expenses in most localities in southwestern Saskatchewan. There were a few districts where crops were almost a total failure, such as about Govenlock, Pontiex and places east of Vanguard in Saskatchewan, and practically the whole of southern Alberta. The oft repeated statement that western farmers are becoming wealthy through bumper crops and greatly inflated prices is not applicable to southwestern Saskatchewan or southern Alberta. It must be admitted that the farmers who received average crops in 1917 and 1918 must have made money, but the majority in the above mentioned sections of the country did not get nearly an average crop. Consequently they are in hard circumstances to-day, in spite of the high prices of grain, because the returns of the bumper crop of 1915 and fair crop in 1916 were consumed largely by debts accumulated during previous years' failures. The moisture record of that part of the country for the past several years shows conclusively that the strictest economy and adherence to the best methods of cultivation are absolutely necessary in order to make a success of dry farming. In the Consul district since 1910 there have been almost four crop failures, one poor crop, three fair crops and one bumper crop. This is a record of trying conditions which is almost sufficient to discourage the stoutest hearts and bankrupt the most industrious.

"One very striking thing noticed this last season, which is one redeeming feature of this dry belt, was the yield of grain on such low precipitation. The following table shows the precipitation for the years 1917 and 1918 at three characteristic points of the district. The records at Nashlyn are typical of the dry belt south of the Cypress hills; those at Clintonel are typical of the top of the Cypress hills where the precipitation is heavier; and those at Swift Current are typical of the district from Gull Lake eastward.

Precipitation Records.

Location.	1917.		1918.	
	Annual.	Growing Season.	Annual.	Growing Season.
Nashlyn	8·19	2·95	5·51	2·04
Clintonel	13·16	5·13	10·36	6·30
Swift Current	10·25	4·19	10·52	5·62

"Last season's crop, low as it was, showed the wonderful ability of these western prairies to produce crops under the most adverse circumstances. Many a farmer who in June despaired of his crop, harvested as much as five and eight bushels per acre. A crop near Elbow, Saskatchewan, that promised in June to be almost a failure, yielded twenty-five bushels per acre on well summer-fallowed ground. Thorough cultivation saved many crops last summer and proved that good farming is always advisable. There have been seasons when grain on stubble brought greater returns than that on summer-fallow, yet such seasons are rare and should not induce people to slacken up on the cultivation of the land.

"The above remarks pertain to the farming conditions of the district in general. Turning to the irrigated areas we find that the results are better, to a greater or less degree, depending upon the amount and frequency of the irrigation, and the crops grown. On the uncultivated lands irrigated grass yielded, on the average, about one ton per acre. On the cultivated areas the yield of hay was probably a little greater, averaging nearly one and one-half tons per acre. This is rather low for cultivated hay, but nearly all of the meadows should be ploughed up and re-seeded. There was only one field of thoroughly irrigated grain; the yield of wheat was forty-two bushels per acre, and of oats sixty bushels. This field was irrigated early in April with flood water and seeded afterwards, and is certainly a striking example of what may be expected from an application of flood water to well cultivated land. There were a few other fields irrigated in spots, with a material increase in the average yield.

"Only a small part of the irrigable lands of the district were irrigated and only a very small fraction of this area was at all well irrigated. There might be two possible reasons for this, namely, the scarcity of labour owing to the war, and the scarcity of water when most needed. In more than one instance, however, I consider the irrigator not above criticism for this failure to irrigate his land. Practically every irrigator along Battle creek could have derived material benefit by irrigating in May when there was water available for all, instead of attempting to irrigate in June when there was water only for a favoured few. They all see the folly of relying too strongly upon nature to produce crops under dry-farming methods and, instead of leaving expensive works lying idle, are intending to irrigate this coming season in time.

"The schemes on the north side of the Cypress hills have practically remained the same during the last few years and are primarily spring flood schemes for growing wild hay. In one or two isolated spots, little stream kept running by springs are diverted over small patches of cultivated hay meadows in an endeavour to grow feed for winter.

"Along the Frenchman river there was very little irrigation, owing to the destruction of diversion dams, etc. The Bolton, Barroby, Freel, Potter, Strong, and Morrison schemes all suffered the loss of dams and are therefore not operated as gravity schemes. The greater part of the Strong scheme at East End, the largest and most expensive of any in the district, because of the loss of the diversion dam and flumes, will probably not be put under a gravity system for several years at least. Part of this scheme has been sold to small purchasers, one or two of whom of Chinese nationality are contemplating installing pumping plants for the watering of garden truck. Mr. Strong has shown remarkable perseverance in the face of unusual misfortune and has done considerable work in Gallienne coulee with the idea of irrigating about four hundred acres of land south of the Frenchman river. It is to be hoped that the results will repay him for his effort. The Morrison scheme, just below, has also virtually ceased, for the present at least, to exist as a gravity system, and the five owners are contemplating the installation of pumping plants. Two are already in operation, one of which enabled the owner to put up considerable hay when otherwise none would have been obtained. (Alberta timothy sold F.O.B. East End for $27.50 per ton in the spring of 1918, at which price not many tons are required to pay for a pumping plant). Besides the irrigation from the two pumping plants mentioned above, there were also a few small fields on the tributaries of the Frenchman river irrigated.

"Along Battle creek the schemes are practically all in excellent working order and could be worked with a fair degree of efficiency. Comparatively speaking, little water was diverted however, except through the ditch of Marshall and Gaff, most of which water is known to have been lost by seepage and

probably returned to the creek. As usual, Lindner Brothers used a liberal allowance of water on their small hay meadow.

"Since there is room for much improvement in this district, there is still a good field here for missionary effort along irrigation lines. The sudden demand of the people of a certain section of southern Alberta for irrigation, shows that people have faith in irrigation and will insist upon having it if obtainable at a reasonable cost. It must be admitted that the greatest obstacle to irrigation development in the Cypress Hills district is the fact that the water is not available when most needed. Surveys have demonstrated that this drawback can be largely overcome in some drainage basins by the construction of reservoirs at a reasonable cost. Demonstration work may prove that a certain amount of flood water can be very advantageously used in the early irrigation of well cultivated grain land..

Summary of Crop Report for 1918, Cypress Hills District.

Classification.	North.	South.	East.	West.	Total Acres.
Area Irrigated.					
Cultivated land—					
Alfalfa		115	....		.....
Timothy		230	70		.....
Bromus		35	130		.....
Mixed grasses		.....	66		.....
Western rye		.....	....		.....
Sweet clover		.....	....		.....
Green feed		544	16		.....
Grains		280	55		.....
Potatoes		.....	2		.....
	No Report submitted.	1,204	339	No Report submitted.	1,543
Land not cultivated—					
Wild hay		1,239	2,302		.....
Grazed		960	10		.....
		2,199	2,312		4,511
Area Irrigable but not Irrigated.					
Cultivated land—					
Alfalfa		.....	13		.....
Timothy		.....	90		.....
Bromus		.....	40		.....
Western rye		33	10		.....
Green feed		130	.....		.....
Grains		1,225	716		.....
Fallow land		538	115		.....
Garden		.....	50		.....
		1,926	1,034		2,960
Land not cultivated—					
Wild hay		504	350		.....
Grazed		7,620	9,500		.....
		8,124	9,850		17,974
Area not reported upon		50	1,853		1,903
Totals		13,503	15,388		28,991

NOTE.—"The crops from the area not reported upon are estimated as follows: East District, irrigated 400 acres wild hay. Unirrigated 803 acres pasture, 200 acres hay, 350 acres grain. South District, unirrigated, 50 acres green oats."

Evaporation from a free water surface.—The data hereunder have been gained by using galvanized iron tanks four feet in diameter and eighteen inches deep set in the ground with the top from one to two inches above the ground. Daily measure-

ments were made of the quantity of water added or taken out to keep the water surface at a fixed point within the tank at approximately the same elevation as the surrounding ground.

COALDALE, ALTA.

Month.	Total Evaporation in Inches.				Average 4 Years.
	1915.	1916.	1917.	1918.	
April	5·68	1·51	2·55	3·20	3·24
May	4·28	5·12	4·83	6·76	5·25
June	2·26	4·68	5·78	7·88	5·15
July	4·38	6·20	9·20	7·68	6·86
August	4·97	4·70	5·23	6·79	5·42
September	2·93	3·59	4·35	3·76	3·66
Total	24·50	25·80	31·94	36·07	29·58

STRATHMORE, ALTA.

Month.	Total Evaporation in Inches.				Average 4 Years.
	1915.	1916.	1917.	1918.	
April	4·22	2·59	2·09	2·88	2·94
May	4·73	3·46	3·70	4·58	4·12
June	4·33	4·59	4·60	5·83	4·84
July	6·47	4·84	5·88	6·13	5·83
August	4·25	3·16	3·66	4·01	3·77
September	2·27	2·66	2·27	2·62	2·45
Total	26·27	21·30	22·20	26·05	23·95

BROOKS, ALTA.

Month.	Total Evaporation in Inches.				Average 1 Year.
	1915.	1916.	1917.	1918.	
April				5·68	5·68
May				8·47	8·47
June				8·50	8·50
July				9·57	9·57
August				6·80	6·80
September				3·84	3·84
Total				42·86	42·86

UNIVERSITY OF ALBERTA. EDMONTON, ALTA.

Month.	Total Evaporation in Inches.				Average 1 Year.
	1915.	1916.	1917.	1918.	
May 11–31				6·50	.....
June 1 to Sept. 2				13·245	.....
Sept. 3–30				2·466	.....
Total				22·111	.....

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LIST OF PUBLICATIONS OF THE RECLAMATION SERVICE.

Annual Stream Measurement Report, 1909 to 1917.

Annual Irrigation Report, 1906 to 1915.

Irrigation Surveys and Inspections Report, 1915; (1915-16); (1916-17); (1917-18).

Western Canada Irrigation Association Report (1st to 10th Convention).

International Irrigation Congress Report (1914).

Bulletin No. 1, Irrigation in Saskatchewan and Alberta.

Bulletin No. 2, Alfalfa Culture.

Bulletin No. 3 Climatic and Soil Conditons, C.P.R. Irr. Block.

Bulletin No. 4, Duty of Water Experiments and Farm Demonstration Work.

Bulletin No. 5, Farm Water Supply.

PAMPHLETS:

Address by S. G. Porter: "Practical Operation of Irrigation Works";
Extract from W.C.I.A. Report, 1914.

" " Dr. Rutherford: "Inter-dependence of Farm and City";
Extract from W.C.I.A. Report, 1914.

" " Mr. Don. H. Bark; "The Actual Problem that Confronts the Irrigator."
Extract from W.C.I.A. Report, 1914.

" " Mr. Don. H. Bark: "Practical Irrigation Hints for Alberta";
Extract from W.C.I.A. Report, 1915.

" " Mr. Don. H. Bark: "Alfalfa Growing";
Extract from W.C.I.A. Report, 1915.